PTS 3.1 C
Portable Test System
Operation Manual



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1. Safety

The following symbol appears on the product and in the operation manual with the meaning:



Caution! Please consult the operation manual before using the instrument.
Failure to follow or carry out instructions preceded by this symbol may result in personal injury or damage of the device and the installation.



General precautions for use



To prevent electric shock:

- **This product has to be only used by qualified personnel practicing applicable safety precautions.**
- **Use caution during installation and use of this product; high voltages and currents may be present in circuit under test.**
- **Local safety regulations must be observed.**

Precautions for use of PTS 3.1 C in measurement mode

- **It is not recommended to use the PTS 3.1 C direct current inputs to measure in unprotected installations (on secondary side of non-intrinsically safe current transformers, in installations without protection fuses).**

- **Use the 1A/10A current connectors only, if the current path can be opened during the measurements without danger for the operator, the equipment under test and the instrument itself.**

Warning! The voltage across the 1A/10A current connectors must not exceed 440 VAC in the case of a failure! The correct operation of the built-in relays and the protection fuses (1.6AFF / 16AFF) is not guaranteed at fault voltages >440VAC.

2. General

The PTS 3.1 C portable test system consists of an integrated single-phase current and voltage source and a single-phase electronic reference standard of accuracy class 0.1 %. Characteristic features of the PTS 3.1 C are its wide measuring range, high accuracy and high tolerance to unwanted external influences.
The PTS 3.1 C allows the monitoring of meter installations as well as analysis of the local mains conditions.

Advantages

- Easy verification of meters under precise load conditions, using the built-in, compact, current and voltage source
- Automatic operation with predefined load points without the need for an external PC
- Exchangeable Compact Flash (CF) memory card for measurement results and customer data
- Display of vector diagram for analysis of the supply conditions
- User-friendly system for data input and operation of combined source and reference meter
- The system may be used either as a stand-alone reference standard meter, or together with the integrated power source

Functions

- Independent generation of single-phase loading conditions for verification of meters
- Active, reactive and apparent energy measurement for single phase 2-wire systems with integrated error calculator and pulse output
- Vector diagram, harmonics spectrum and wave form display for analysis of the mains conditions
- Burden measurement of Current Transformer (CT) and Potential Transformer (PT)

Application

- On site meter measurements
- Verification of energy registration
- Verification of the circuit load conditions

Options

- Software CALSOFT
- Error compensated clip-on CT’s up to100 A

For any further information concerning the use of this instrument, or in the event of any questions, you are invited to contact EMH / MTE directly at:

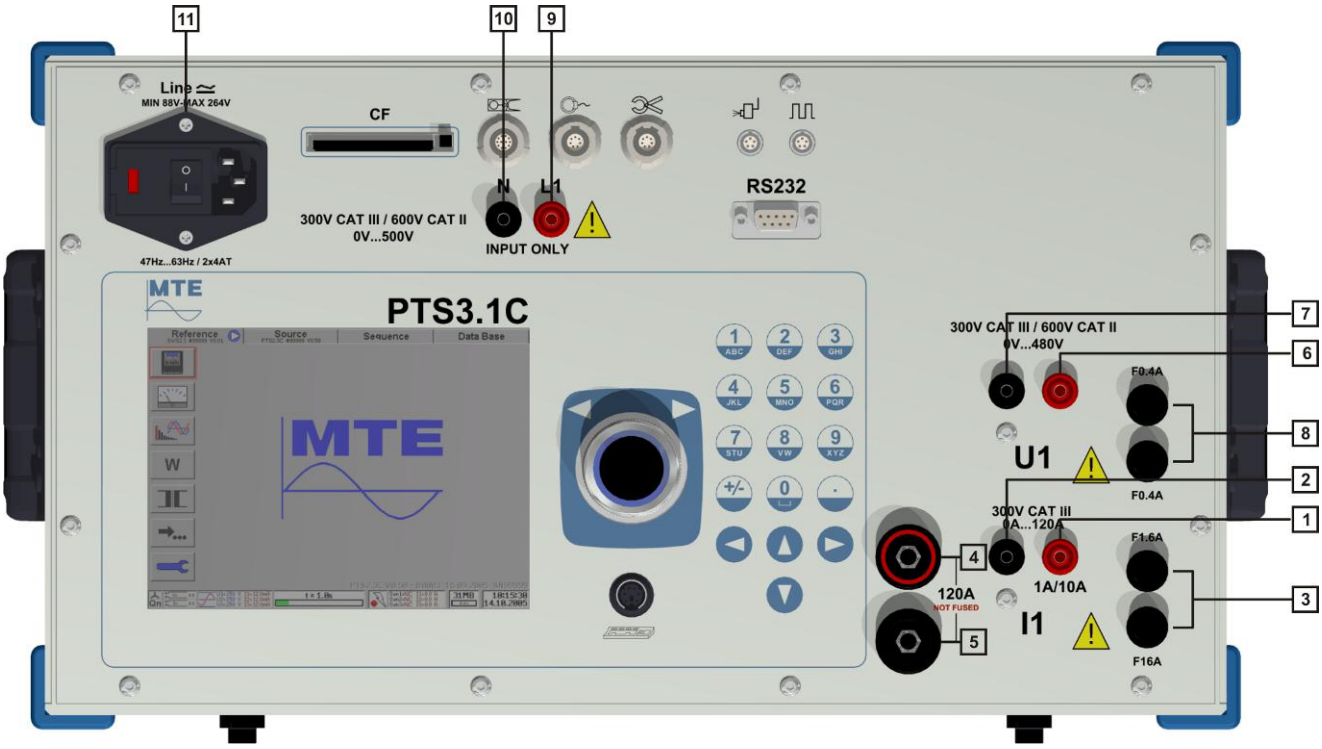
MTE Meter Test Equipment AG
Dammstrasse 16
CH-6304 Zug
Switzerland
Phone: +41-41-724 24 48
Fax: +41-41-724 24 25

EMH Energie-Messtechnik GmbH
Vor dem Hassel 2
D-21438 Brackel
Germany
Phone: +49-4185-5857-0
Fax: +49-4185-5857-68

3. Connectors and control elements and start-up

3.1 Connectors and control elements

The various connections are accessible on the front panel of the instrument after opening the outer cover. Operation may be carried out via the integrated keyboard or through the serial interface.



[1] 1A/10A red current connectors for I

Current flow direction out of PTS 3.1 C, Imax=12A, protected with fuses (see [4])
Connection: 4 mm insulated socket

Function

Output: Mode: Test System or Reference + Source
Back wire: Mode: Reference

[2] 1A/10A black current connector for I

Current flow direction into PTS 3.1 C, Imax=12A, protected with fuses (see [4])
Connection: 4 mm insulated socket

Function

Back wire: Mode: Test System or Reference + Source
Input: Mode: Reference

[3] 1A/10A fuses for current connection I

For 1A internal range: Fuse 1.6A / 500 V, fast acting
For 10A internal range: Fuse 16A / 500 V, fast acting

[4] 120A red current connector for I

Current flow direction out of PTS 3.1 C, Imax=120A, no fuses
Connection: 6 mm high current connector

Function

Output: Mode: Test System or Reference + Source
Back wire: Mode: Reference

[5] 120A black current connector for I

Current flow direction into PTS 3.1 C, Imax=120A, no fuses
Connection: 6 mm high current connector

Function

Back wire: Mode: Test System or Reference + Source
Input: Mode: Reference

300V CAT III
0A … 120A

Attention! The voltage between current terminals ([2], [3], [5], [6]) and case or protecting earth shall not exceed 300 V, if the instrument is applied in measurement category CAT III environment.

120A
NOT FUSED

Attention! The 120A current connectors [5], [6] are not protected with fuses. Never connect line voltage to the connectors [5] and [6] of the same phase.

Warning! When testing meters with closed voltage links, the current paths are connected with the voltage paths. Dangerous line voltages are present on the current paths in this case!

[6] Red voltage output phase connector for U

Umax = 480VAC
Connection: 4 mm insulated sockets

[7] Black voltage output neutral connector U

Internally connected with [11]
Connection: 4 mm insulated sockets

[8] Fuses for voltage output connection for U

Fuses: 2 x 400mA / 500 V, fast acting

Attention! U1 is output only, used in Mode Test System or Reference + Source. Do not connect to line voltage.

[9] Red voltage input phase connector for L

Umax=480VAC
Connection: 4 mm insulated sockets

[10] Black voltage input neutral connector N

Internally connected with [8]
Connection: 4 mm insulated socket

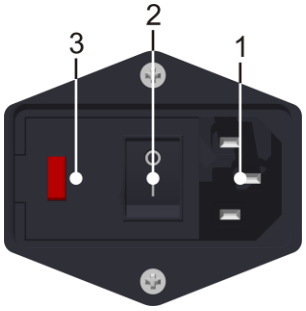
INPUTS ONLY

Attention! The connectors L, N are INPUTS ONLY.

300V CAT III/600V CAT II
0 … 480V

Attention! The voltage between voltage terminals ([7], [8], [10], 11]) and case or protecting earth shall not exceed 300 V, if the instrument is applied in measurement category CAT III environment, and not exceed 600 V, if applied in CAT II environment.

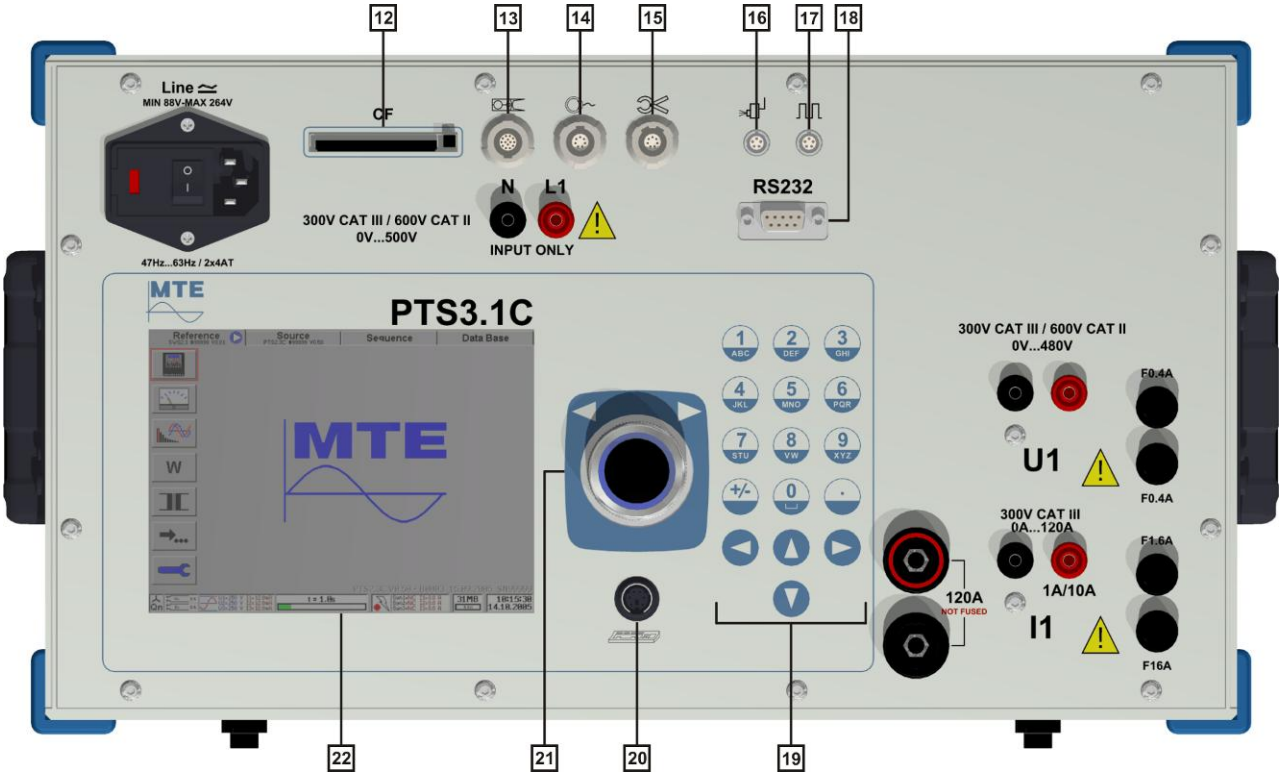
[11] Supply voltage connection, mains switch, fuses



1 ⇨ Supply voltage connection:
88_{min} … 264_{max} VAC, 47 … 63 Hz

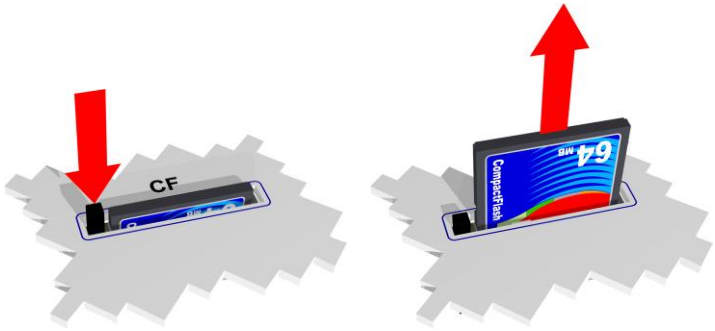
2 ⇨ Mains switch

3 ⇨ Fuses 2 x 4A / 250 V slow blow
(below the cover)



[12] Compact flash card

Removable compact flash (CF) memory card for storage of measurement data, administrative data and instrument settings.



Push on button to eject the CF card and then pull out the card.

When reinserting the card, regard the correct orientation. The side near the eject button has a thin guideway, the opposite side a thick guideway.

Warning! Do not remove the CF card, if the card is actually accessed, indicated with a red background of the CF status indication on the display. Not following this procedure may lead to corrupted files and loss of data.

The most safe procedure is to switch off the PTS 3.1 C before removing or inserting the CF card.

[13] Connection for 100A electronically compensated clamp-on current transformer

Connection: 14 pole Redel socket, suitable exclusively for an electronically compensated MTE clamp-on current transformer



[14] Connection for flexible LEMflex 30A/300A/3000A current transformer

Connection: Redel socket, 6 pole, suitable exclusively for an electronically adjusted LEM*flex* current transformer



[15] Connection for 1000A clamp-on current transformer, electronically adjusted

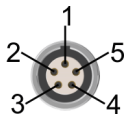
Connection: Redel socket, 6 pole, suitable exclusively for an electronically adjusted MTE clamp-on current transformer



[16] Impulse input

The impulse input can each be used for a scanning head (e.g. the SH 2003) and can also be used to connect to a retransmitting contact of the device being tested.

Type: Lemo socket, 5 pole



Pin 1 ⇨ +11 ... 13V (I<60mA) (supply of scanning head)
Pin 2 ⇨ f_{in} max. 100 Hz (slow input, anti-bounce)
Pin 3 ⇨ f_{in} max. 200 kHz (fast input)
Pin 4 ⇨ GND
Pin 5 ⇨ screen

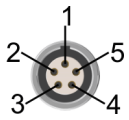
[17] Impulse output

The default setting for the mean frequencies of the impulse output is:

Proportional to total active power PΣ

The reference power and the meter constant can be reconfigured.

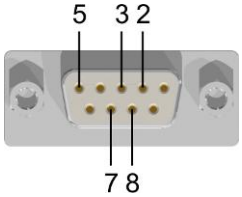
Type: Lemo socket, 5 pole



Pin 1 ⇨ +11 ... 13 V (I<60mA)
Pin 2 ⇨ not used
Pin 3 ⇨ f_{out} max. 60kHz (1:1)
Pin 4 ⇨ GND
Pin 5 ⇨ screen

[18] Serial Line Interface RS232

Connection: 9 pole SUB-D connector



Pin 2 ⇨ TxD
Pin 3 ⇨ RxD
Pin 5 ⇨ GND
Pin 7 ⇨ CTS
Pin 8 ⇨ RTS

[19] Alphanumerical keypad and cursor keys

[20] Turnable Handling Button (THB)

[21] Connector for external keyboard (PS2)

[22] Color LCD display

3.2 Installation of test circuitry and start-up

Attention! Disconnect or switch off dangerous voltages in the measuring set-up during connecting or disconnecting the PTS 3.1 C whenever possible. Regard local safety regulations for connection of measuring instruments to the installation.

Steps to connect and disconnect the PTS 3.1 C

Connect the PTS 3.1 C

1. Connect clamp-on CT at PTS 3.1 C first, if used
2. Connect scanning head SH 2003 or hand switch at PTS 3.1 C , if used.
3. Connect the supply cable to the PTS 3.1 C and switch-on the instrument
4. Connect voltage cables first at PTS 3.1 C and then at measuring set-up.
5. Connect the measuring currents:

   a) Connect current cables first at PTS 3.1 C and then at measuring set-up, if direct current inputs are used.

   b) Fix clamp-on CT on wire of measuring set-up, if clamp-on CT is used.

Disconnect the PTS 3.1 C

1. Disconnect the measuring currents:

   a) Disconnect current cables first at measuring setup and then at PTS 3.1 C, if direct inputs are used.

   b) Remove clamp-on CT from wire of measuring set-up, if clamp-on CT is used.
2. Disconnect voltage cables first at measuring set-up and then at PTS 3.1 C
3. Switch-off the PTS 3.1 C and disconnect the supply cable.
4. Disconnect scanning head SH 2003 or hand switch at PTS 3.1 C, if used.
5. Disconnect clamp-on CT at PTS 3.1 C.

Attention! Connect the clamp-on current transformer always first to the PTS 3.1 C and then to the cable of the test circuitry. Never unplug the clamp-on CT connector at the PTS 3.1 C during operation. This is to avoid open circuiting of the clamp-on CT secondary winding.

Connection examples using the PTS 3.1 C for measurements on various types of devices under test, and for different connection modes, are given in Chapter [11]

3.2.1 Paths of Current

There are two possible connections for each phase. For currents up to 10A the two 4mm safety sockets are used. For higher currents up to 120A the two high current connectors are used.



Attention! Only one connection (1A/10A or 120A) for each phase may be connected at a time and the connection used must be the same as the selected 10A or 120A in the installation menu.

Starting from the red socket, the current path of a phase is routed through the device under test back to the black socket.

The current outputs are isolated from the voltage outputs and the supply voltage. Two fuses are used to protect each phase: 1.6A for the 1A range and16A for the 10A range (both fuses are fast acting types).



Attention! If the clamp-on current transformers are used, connect them first to the PTS 3.1 C and then to the cables of the test circuitry to avoid open circuiting of the clamp-on CT's secondary windings.

3.2.2 Paths of Voltage

The voltage paths for voltage output (U) and measurement, voltage inputs (L1, N) are separately realized.
The **voltage output U** is used for the direct connection of device under test to the PTS 3.1 C in the **Test and Source modes**. The voltage output is potential free and protected against accidental short circuit. The output is protected by two 400mA fast acting fuses.
the **voltage input L1, N** is used for the direct connection of device under test to the PTS 3.1 C in the **Measurement mode**. The neutral connector is connected to the neutral connector of the voltage output (black socket U).

3.2.3 Special Circuits

For connecting devices under test, where current and voltage path are not separable (e.g. electricity meters without voltage links) the corresponding current and voltage sockets of the PTS 3.1 C can be connected together.



Warning! In this case the current paths are at the voltage potentials. Dangerous high voltages are present on the current paths.

3.2.4 Connecting a PC

The PTS 3.1 C Portable Test System has an RS232 PC communication interface for remote control. In this manner testing processes can, to a large extent, be run automatically.

The required interface of the PTS 3.1 C is selected and configured via the menu Data Base Basic settings. The interface connector of the PTS 3.1 C should be connected to the PC serial interface. The commands available are described in a separate document.

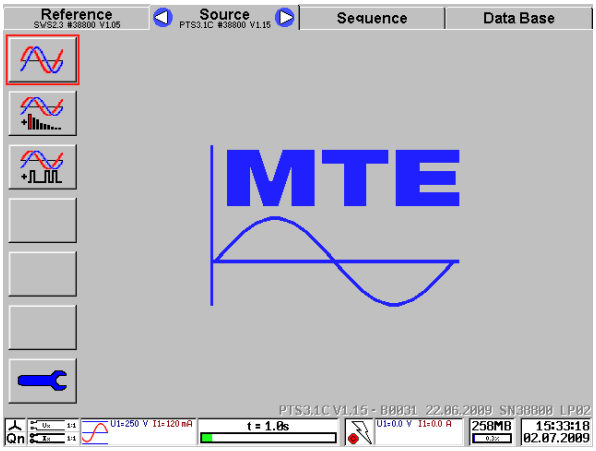
4. Operation principles

Before operating carefully read the safety precautions in chapter [1].

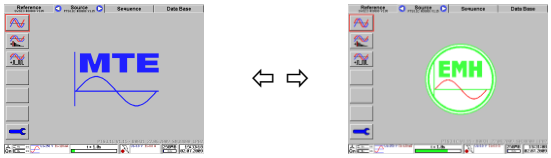
The following section deals with manual operation of the PTS 3.1 C. Operation of the instrument via serial interface commands is explained in a separate operation manual.

4.1 Display and control elements

4.1.1 Display



After start-up the **Source Menu Card (MC)** is displayed in the form of a register card with the Logo cycling between MTE and EMH.



The various selectable functions of the menu are shown at the left hand side of the display in the form of **Functional Buttons (FB)** with graphical indication of the function.
At the bottom status information is displayed.

Source PTS3.1C #38800 V1.15	**Menu Card (MC)**

MC status

Source PTS3.1C #38800 V1.15

Active MC
Type of instrument (PTS3.1C) serial number (#38800) and firmware version (V1.15) are indicated in the menu card.
The MC's Reference and Data Base are always active. The MC's of Source and Sequence are activated depending on selected basic mode.

Source

Inactive MC
The menu card is 'grayed out'. Type of instrument, serial number and firmware version are not indicated.
FB's and sub menus can still be selected, if selection is activated in basic settings, but cannot be executed. Only the FB's, which are supported by the actual instrument configuration, can be executed.

	Functional Button (FB)

The functional buttons are used to call sub menus or functions or to enter data or select settings. The function is indicated in graphical from on the button directly. Further description can be found in section [4.1.4/ 4.1.5].

Menu Cards (MC) and Functional Buttons (FB) of main menu
A detailed description of the listed functions and sub menus can be found in the chapters indicated in brackets [].



Portable Reference Standard


Error measurement [8.2]


Measurement [8.3]


Wave form analysis [8.4]


Energy measurement and register test [8.5]


Transformer tests [8.6]


Special functions [8.7]


Reference meter settings [8.1]



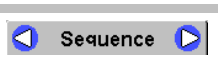
Portable Power Source


Load point and network definition, execution [7.1]


Harmonics [7.2]


RCS Ripple Control Signals [7.3]


System parameters [7.5]



Automatic test run with Portable Test System


Automatic or step by step test run [9.2]


Edit automatic test sequence [9.1]



Data Base



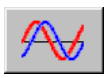
Administrative data [6.4]



Meter data [6.5]



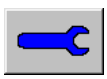
Transformer data [6.6]



Load point data [6.7]



View of results [6.2]



Basic settings of the instrument [5]

The look of the main menus is changing as soon as a sub menu is called. The last selected sub menu is shown with a second column of FB's. and the sub menu displayed in the window on right side of the two FB columns.

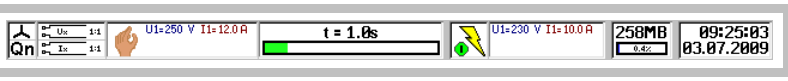


Type and firmware version

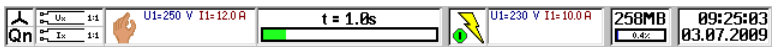
In the main menu at the bottom above the status indications type and version information is displayed.

PTS3.1C	Type of unit
V1.15	Firmware version
B0031	Build code of the firmware
22.06.2009	Date of the firmware
SN38800	Serial number of the unit
LP02	Hardware Version

This information may be required during contact with MTE in the event of a problem.



Status information / Tool-tip



Status information

Most of the time. Status information of the system controlled by the PTS 3.1 C is displayed The display depends on the system configuration. For a detailed description see [4.2].

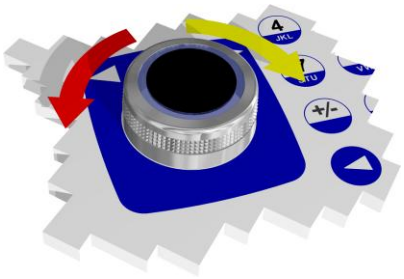


Tool-tip

Each time a new FB is selected a help text is displayed in a so called tool-tip window. The time the window is shown is configurable between OFF, 0.5 .. 10s. For configuration and display of tool-tips in other languages see [5].

4.1.2 Turnable Handling Button (THB)

The **Turnable Handling Button**, further in the manual abbreviated with **THB**, is the most used operating element of the PTS 3.1 C and allows following basic operations:



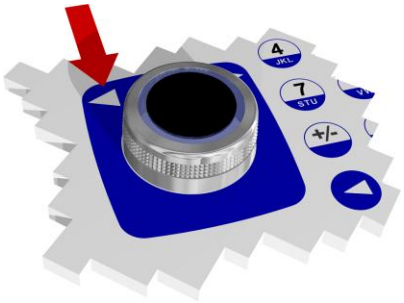
Left / right turning

- Move red selection frame step by step to select soft keys or display regions
- Select out of selection list during inputs
- Change numerical values during inputs
- Move the cursor sign during alphanumerical inputs



Pushing on button

- Activate sub menu, function or input
- Terminate sub menu, function or input
- Activate / deactivate selected area



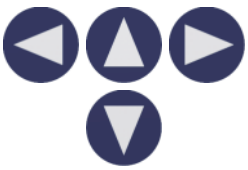
Change left / right between menu cards (MC)

These two keys are exclusively reserved for this function.

4.1.3 Keypad



Alphanumeric keys for input of numerical values and text within the menus.
Repeated key presses allow the text characters shown in the lower part of the key to be selected. In this way both characters and numbers can be selected. The last selected character or number will be inserted into the input field.
The sign below the zero symbolizes a space. It is used to insert space or to delete characters or numbers by overwriting them with a space.



Cursor keys

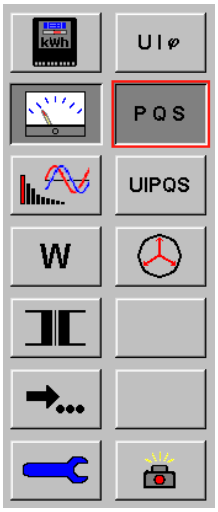
4.1.4 Functional Buttons (FB)

The rectangular fields shown in the display are simulating keys with different functions and settings. They can be selected and executed with the THB.
Because the function of the keys is variable, and the function is indicated on the key itself depending on the menu selected, they are called **Functional Buttons**, further in the manual abbreviated with **FB**.
These keys together with the graphical symbols displayed on them, allow fast and easy operation of the instrument.

Different types of functional buttons



Call of sub menu



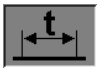


The pressed FB in the first column indicates that the measurement sub menu is active. The FB's in the second column are changing. They belong to the activated sub menu



The pressed FB in the second column indicates that the PQS display is active.

The FB's of the sub menu can directly be selected by moving the red frame to the desired FB by turning the THB.



Pressed functional button
A key shown as depressed indicates that the function is in active state, e.g. input of time base.



Selection with cyclic mode and status indication in the FB
Consecutive key presses cycle between the possible states. The actual state is indicated in the FB itself.
E.g. the connection mode FB has two states. Each key press changes between these two states. A cyclic change between two states is also called toggle mode.





Disabled key
If a key is disabled, it is shown 'grayed out'. The function is blocked. The corresponding FB is not selectable and executable.



Blank key
A blank key can be selected by the THB, but has no function. Blank keys are a reserve for future applications.

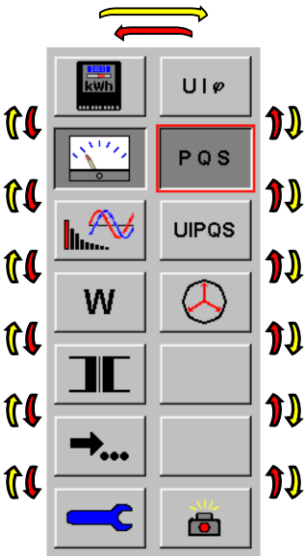


Exit of sub menu
The next higher menu or the calling menu is displayed.

4.1.5 Basic applications of Turnable Handling Button (THB) and Functional Buttons (FB)

Selection of functional button, display region or display field with the THB. Numerical input and selection out of predefined settings with THB.

Selection of Functional Button (FB)





Clockwise turning moves the thin red frame step by step from left column first functional button at the bottom up and the right column down until to the last functional button at the bottom.



Counter clockwise turning moves the thin red frame the same way back.

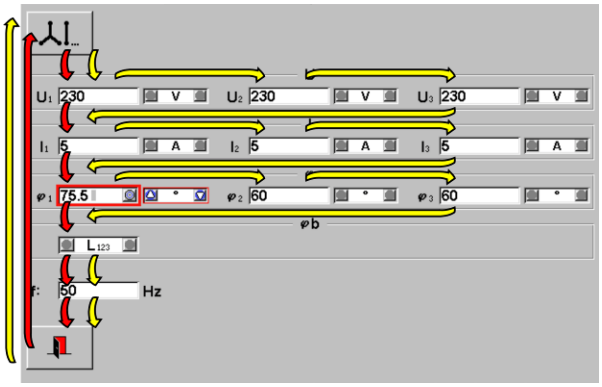


The functional button, where the thin red frame is actually positioned, is selected.



Push on THB to activate or deactivate the selected FB.

Top down selection of input fields with two variants (cyclical mode)





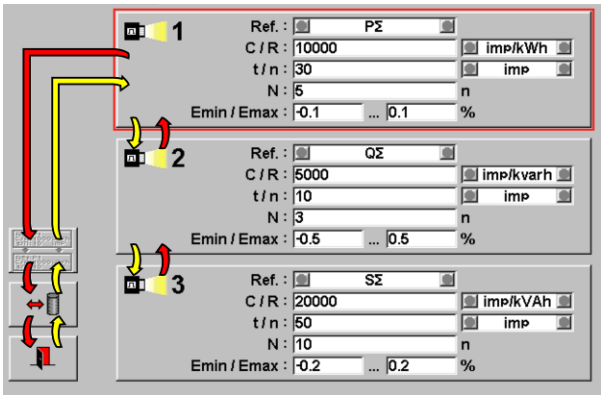
Clockwise turning
Moves the thin red frame through all input fields from left to right and top down.



Counter clockwise turning
Moves the red frame only through the fields in the first column top down.

The selection restarts at the top if the bottom is reached (cyclical mode).

Selection of display regions and fields inside the region



Select display region

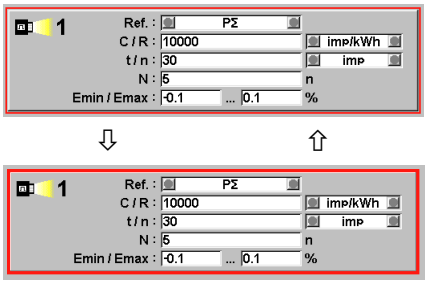


Move thin red frame to the desired display region.



The red selection frame changes between FB's and display regions.

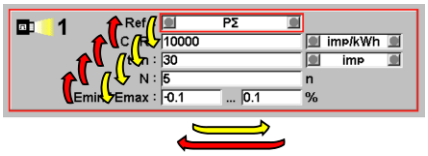
Enable / disable region





Push on THB button at selected display region. The red frame becomes thick and selection of fields inside the region is enabled. As soon as the THB is turned on any side the frame becomes thin again. To disable the region the frame must be selected to be thick again. Then the push button must be pressed to disable the region

Select fields up / down inside the region

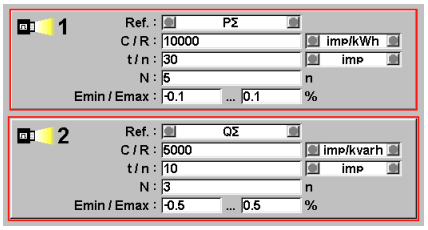




Clockwise turning
The available fields are selected in direction top to bottom and left to right.



Counter clockwise turning
The fields are selected the same way back. The next step after the first field selects the region, indicated with a thick region frame.



Select outside the region

Turning the selection frame outside a selected region will select a second region or an FB outside the region. The selection and activation of a second region is used to copy from region to region.

Numerical data input with keypad or THB



Data input with keypad or THB



The first key press on the THB activates the data input related to the FB. The activation is indicated by the pressed FB, a red frame, a grey cursor sign and the THB symbol. In this example a numerical input can be made directly with the keypad or by turning the THB.



The second key press on the THB terminates the data input. The input is accepted. The cursor sign, the THB symbol and the red frame disappear. The red selection frame is shown around the soft key. Another soft key can be selected by turning the THB.

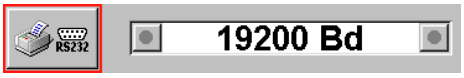
Selection out of predefined settings with cursor keys or THB



E.g. set printer baud rate



The first key press on the THB activates the selection related to the FB. The activation is indicated by the pressed FB, a red frame and up / down cursor symbols. One of the following settings can be selected by turning the THB or using the up / down cursor keys (cyclical mode): 4800 / 9600 / 19200 / 38400 / 57600 / 115200 Baud



The second key press on the THB terminates the selection. The last selected setting is overtaken. The up / down cursors and the red frame disappear. The red selection frame is shown around the FB. Another FB can be selected by turning the THB.

4.1.6 External keyboard (option)

An external keyboard can be connected to the PTS 2.3 C and be used to operate the instrument and to make alphanumerical inputs.

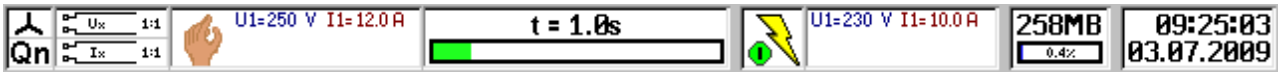
Note: The definition of the keys is based on a German keyboard layout.

Special key functions

Keys	Function
Ctrl + ⇦ or ⇨	Change between register cards (same function as left / right keys at the THB)
⇦, ⇨, ⇧, ⇩	Move selection frame (same function as turning the THB)
Enter	Activate, terminate sub menu, function or input (same function as THB push button)

4.2 Status indications

At the bottom of the display different status indications of the system are visible. The status indications are varying depending on the system configuration. The status indication of the missing modules are replaced with grey fields.





Connection mode and reactive mode

Connection mode

- 4-wire mode
- 3-wire mode (not available at PTS3.1C)

Reactive mode

- Qn Natural (n) mode (90° phase shifters used)
- Qx Artificial or cross-connected (x) (phase - phase voltages with 90° phase shift used) (not available at PTS3.1C).

Voltage and current measurement inputs

Voltage input type

Direct voltage inputs

Current input type

Direct current inputs 120A

Direct current inputs 12A

Current clamps 100A

Current clamps 1000A

LEM clamps 30A

LEM clamps 300A

LEM clamps 3000A

Transformer factors

Status of activation of transformer factors for voltage inputs (upper symbol) and current inputs (lower symbol).

Transformer factors disabled

The ratio is 1. All values are indicated as measured.

Transformer factors enabled

The displayed load values and energies and the ranges indicated in the status section are multiplied with the ratios defined at reference meter settings [8.1].

Selection and indication of voltage and current ranges

Type

Automatic range selection

Manual range selection

Range indication

Normal display

The actual selected end of range value is indicated for voltage (U1) and current (I1).

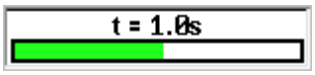
Range overflow

The range indication of inputs, which are overloaded is blinking between red and normal and a repeating beep can be heard.

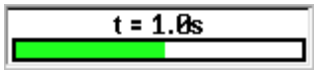
The overload indications disappear as soon as normal conditions are reached again.

Transformer factors activated

The internal selected end of range values 120V and 12A are multiplied with the defined transformer factors (e.g. voltage 1kV:100V = 10, current 100A:5A = 20).



Time base



Internal time base interval

The set time base is indicated. The bar graph shows the actual elapsed time of the running interval.

External control of time base interval



The time base interval is defined by impulses at impulse input 1. The time in brackets indicates the time between the last two impulses at input 1. The Indicated bar graph of the next period is based on this value.



Source ON / OFF status



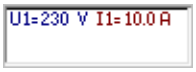
Source OFF indicated with red OFF button and white flash symbol



Source switch on / switch off active indicated with sandglass and yellow flash symbol. The set values are ramped up or down.

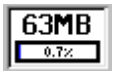


Source On indicated with green ON button and yellow flash

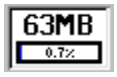


Actual set voltage and current values of the source

Indication of the actual set values for voltage output and current output of the source. The values indicated here are switched on, when the start button is operated.



Compact flash card status



Compact flash card inserted and recognized

The available storage size, e.g. 63 mega bytes of the inserted 64 MB compact flash card is indicated. A bar graph shows the used storage in percentage of the available storage.



The background is displayed red during read or write operations on the flash card.



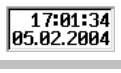
Warning! Do not remove the CF card, if the card is actually accessed. Not following this procedure may lead to corrupted files and loss of data.
The most safe procedure is to switch-off the instrument before removing or inserting the CF card.



No compact flash card inserted



Cyclical data saving active



Time and date

hh:mm:ss	Actual time with h: hour, m: minutes, s: seconds
DD.MM.YYYY	Actual date with D: day, M: month, Y: year

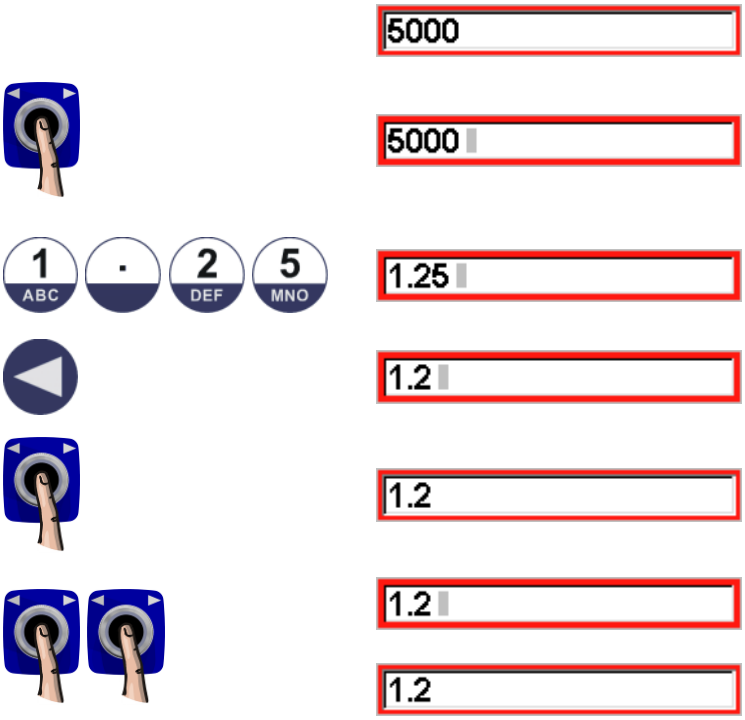
4.3 Input of data

The input of data is achieved using the alphanumeric keypad and the cursor keys or by using an external keyboard (option).

4.3.1 Numerical inputs

E.g. meter constant of device under test.

Input of numbers



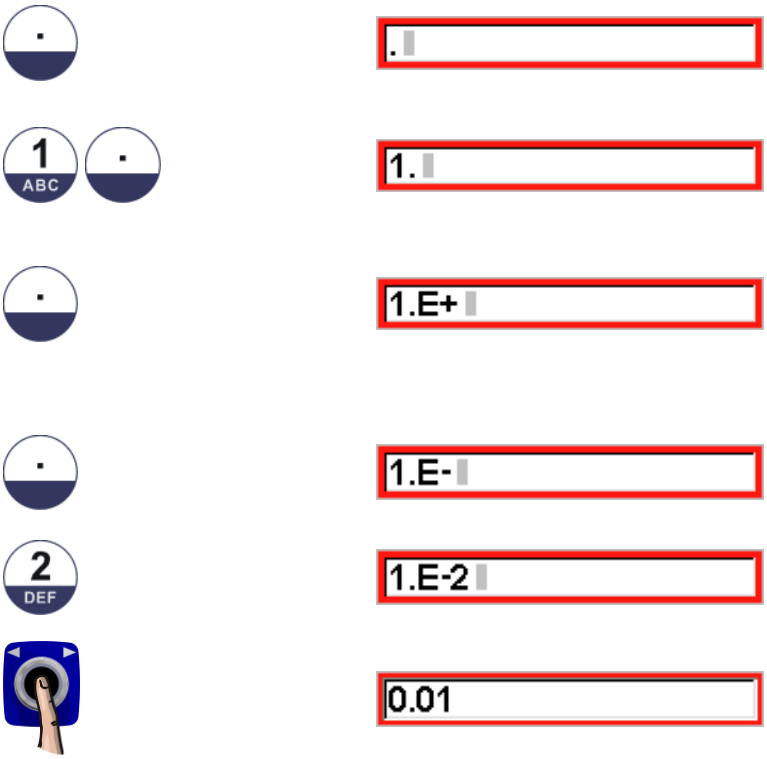
Display of actual meter constant

Pressing the THB button at the selected input field activates the input. The old value is displayed in a thick red frame followed by a grey cursor sign.

Enter the desired value with the keypad. The first entered digit replaces the previous value.
Incorrectly entered inputs can be cleared with the left cursor key, digit for digit.
The input is completed by pressing the THB button. The red frame becomes thin, the grey cursor sign disappears and the new value is saved.

If an input should be activated by mistake, the input function can be aborted by operating the THB button once again. In this case the original value is retained.

Input of numbers with exponent



Decimal point:
If at start of input, or immediately after a number has been entered, the point key is depressed, a decimal point is inserted

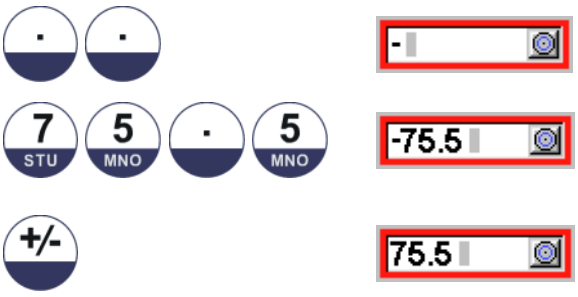
Positive exponent: If the point key is operated a second time immediately after a decimal point has been entered, an **E+** is inserted for a positive exponent.

Negative exponent: If the point key is pressed again after the **E+** is displayed**,** an **E-** is inserted for a negative exponent.

The input is completed by pressing the THB button. The red frame becomes thin, the grey cursor sign disappears and the new value is saved.

Input of minus sign

E.g. input of phase angle settings.



Minus sign with point key: If at start of input the decimal point key is depressed twice a minus sign is inserted.
If the point key is operated a third time a normal decimal point is inserted.

Input, change sign with +/- key:
Operating the +/- key inserts a minus sign or changes the sign of an already entered number (cyclical mode).

4.3.2 Alphanumerical line input

With the keypad the numbers and characters shown on the upper and lower half of the keys and with the point key some additional application dependent special characters can be entered.
Input can also be made with an external keyboard (option) connected to the PTS 3.1 C.



Select input format
Repeated key operation changes between (cyclical mode):



Capital letters

Lower case letters

Numbers

Example: Input of meter type name





Activate input
Push on THB to activate the input
The thick red frame is shown around the line and a yellow cursor sign is displayed.





Input of character
Repeat key operation within less than 1 second until the desired character is shown. Wait until the character is inserted and the cursor has moved one position to the right.





Input with capital letters





Move cursor one position left
Counter clockwise turning of the THB moves the cursor one position to the left. With further turning the cursor can be moved until the begin of the line.





Insert character
The character is inserted at the position before the cursor.





Change to input of numbers

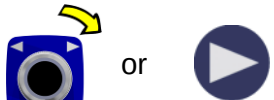








Delete character





Move cursor one position right
Clockwise turning of the THB or operating the right cursor key moves the cursor one position to the right. Further turning or cursor key operations moves the cursor to the end of the line.





Change to capital letters









Change to lower case letters







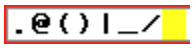




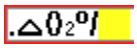
Terminate input
Push on THB to terminate the input.



Input of special characters
The listed seven special characters can be selected by repeated key operation of the point key (cyclical mode).



Special characters at standard line input



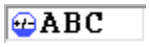
Special characters at file name line input

4.3.3 Alphanumerical field input

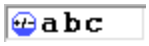
With the keypad the numbers and characters shown on the upper and lower half of the keys and with the point key some special characters can be entered.
Input can also be made with an external keyboard (option) connected to the PTS 3.1 C.



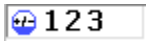
Select input format
Repeated key operation changes between (cyclical mode):



Capital letters



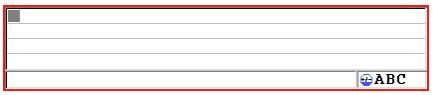
Lower case letters



Numbers

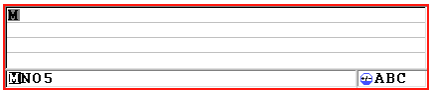
Example: Input of comment





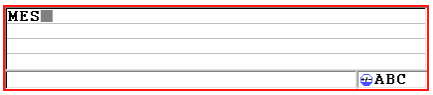
Activate input
Push on THB to activate the input
A grey cursor, a red frame and an input line at the bottom are displayed. New text is always inserted at the actual position of the grey cursor. The old character or number will be overwritten.





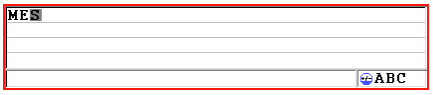
Input of character
With repeated key operation within one second, the characters and numbers listed in the bottom line can be selected in cyclic mode.





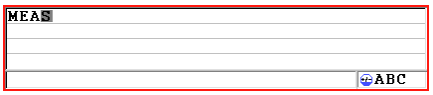
Input of capital letters
If no further key pressure follows within one second, then the last inverse displayed character or number is inserted in the text. The grey cursor moves one position to the right.



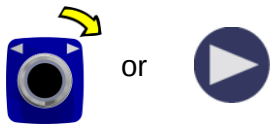


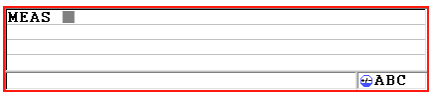
Move cursor one position left
Counter clockwise turning of the THB moves the cursor one position to the left. With further turning the cursor can be moved until the begin of the line.





Insert character
The character is inserted at the position before the cursor.



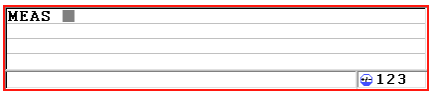


Move cursor one position right
Clockwise turning of the THB or operating the right cursor key moves the cursor one position to the right.



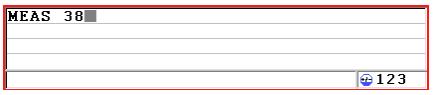
Input of space
The special sign below the 0 indicates a space character.



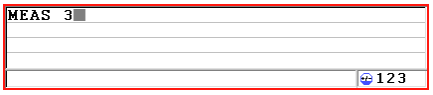


Change to input of numbers



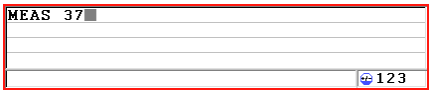




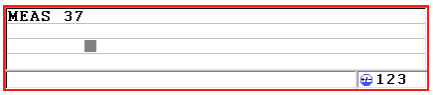


Delete character



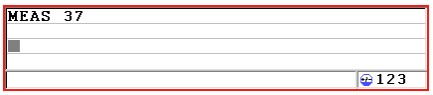






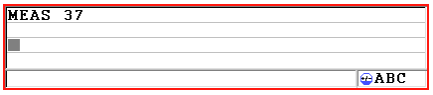
Change line
Operating the down cursor two times moves the cursor to lines down.





Move to begin of line
Turn the THB counter clockwise until the cursor is at the begin of the line.

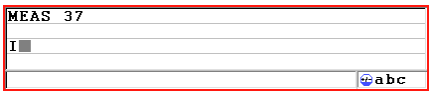




Change to capital letters

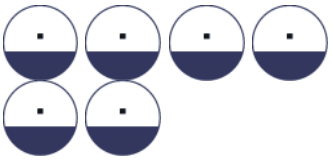


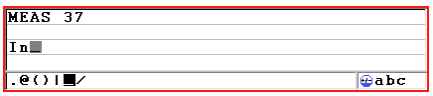




Change to lower case letters

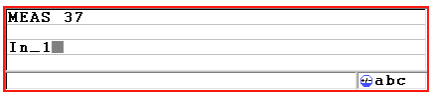






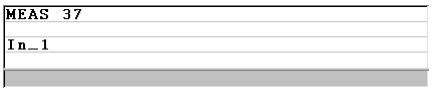
Enter special character
Operate the point key six times to select the underline character.





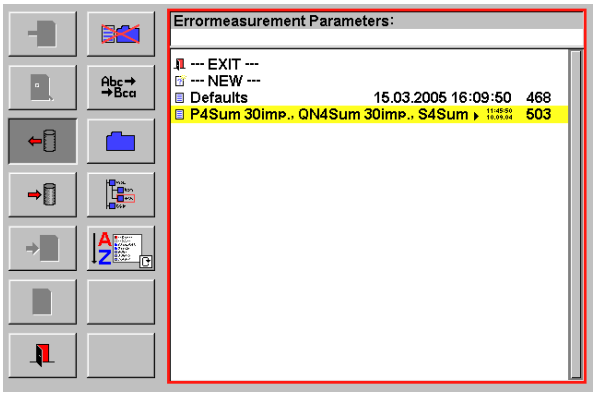
Enter number in text mode





Terminate input
Push on THB to terminate the input.

4.4 Load / save settings



Load / save settings menu
The function can be called from different menus to load or save parameters (e.g. error measurement parameters).
The data base file selection menu is called and parameters can be loaded from a file or saved to a file on the compact flash card. The FB's of data base menu, which are not used, are displayed "grayed out" and not accessible.
The file defaults is loaded at power on. Desired default settings can be saved under this name.

Note: The files are only available and the default parameters are only loaded, if a compact flash card is inserted at the PTS 3.1 C.

Indications / settings

Defaults 15.03.2005 16:09:50 468 P4Sum 30imp., QN4Sum 30imp., S4Sum 503	**Indications**

P4Sum 30imp., QN4Sum 30imp., S4Sum

15.03.2005 16:09:50

468
503

File name
The file name is shown beside the blue file symbol.

Date and time
Date and time when file was saved is shown. Depending from length of file name either in big letters or with flash and small letters.

File size
The file size is shown in byte.

Load settings

Activate load from data base with THB

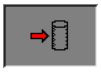
--- EXIT ---
--- NEW ---
Defaults 15.03.2005 16:09:50 468
P4Sum 30imp., QN4Sum 30imp., S4Sum 503

--- EXIT ---
Defaults

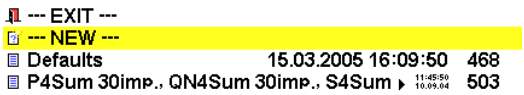
Select / load settings
Move yellow line to desired file with THB and push THB to load the new settings. The calling menu is displayed again.

Cancel load settings
Move yellow line to EXIT with THB and push THB to cancel the load function. The actual settings remain unchanged. The calling menu is displayed again.

Save settings

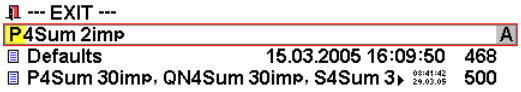


Activate save to data base with THB



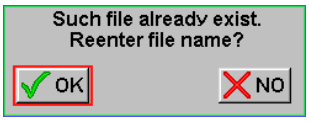
Select / save as new settings

Move yellow line to desired file with THB and push THB to activate input of new name



Define name

A name is proposed. Change name if desired, see [4.3.2]. Terminate saving with push on THB.

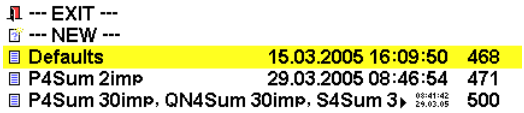


Reenter file name

The proposed file name already exist.

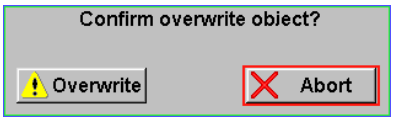
OK: Entry field for define name appears again.

NO: Cancel save function.



Select / save as defaults

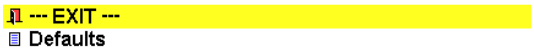
Move yellow line to Defaults with THB and push THB.



Confirm overwriting

Overwrite: Overwrite Defaults with new settings. At next power on this settings will be loaded as default.

Abort: Cancel save function. The actual defaults settings remain unchanged.



Cancel save settings

Move yellow line to EXIT with THB and push THB to cancel the save function.



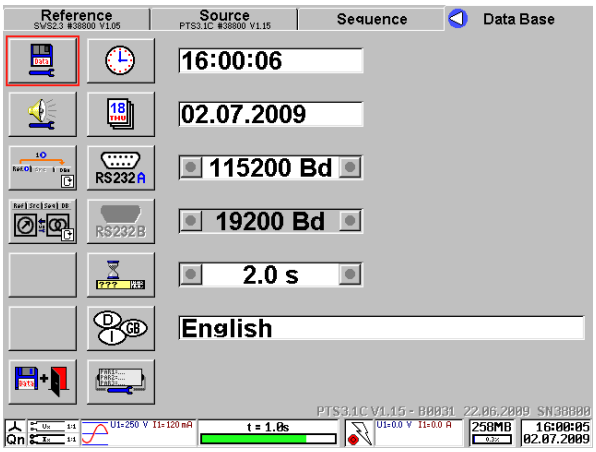
Exit, back to calling menu



Delete file / rename file / create folder / browse folder

Description of these functions see [6.1]

5. Data Base Basic settings of the instrument



Basic settings of the instrument menu
The following settings are displayed:

- Time 16:00:06
- Date 02.07.2009
- Baud rate 115200 Bd for the serial interface RS232A
- Baud rate 19200 Bd for the serial interface RS232B (not available at PTS 3.1 C)
- Tool-Tip timeout 2.0s
- Language is English

Settings displayed on cyclical FB:

- Menutab selection mode
- Basic Control Mode

Indications / settings [4]

Time

The clock will be stopped and the time displayed.

16:00:06 Set the RTC time in the format **hh:mm:ss**. The separator (:) will be generated automatically.

h: hour, m: minute, s: second

The clock will start with the new time.

Date

02.07.2009 Set the RTC date in the format **dd.mm.yyyy**. The separator (.) will be generated automatically.
d: day, m: month, y: year

Baud rate of serial interface RS232A

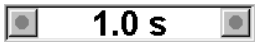
The serial interface RS232A can be used for the communication to a PC or can be used for connecting a serial printer. The printer settings are made separately in the menu **printer and save parameters settings** [5.1]

115200 Bd Set panel baud rate: The following settings can be selected: 4800 / 9600 / 19200 / 38400 / 57600 / 115200 Baud.

Baud rate of serial interface RS232B (not available at PTS 3.1 C)



Tool-Tip timeout



The Tool-Tip timeout can be selected from 0.5s to 10s. The Tool-Tip text will be displayed in the status line for the defined time.



The Tool-Tip description will not appear in the status line.



The Tool-Tip will be displayed during the defined time in the status line of the screen and explains the function of the FB.

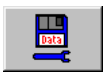


Call **Language selection** menu [5.2].

Load different languages for tool tips, menu and units from the directory **Languages**



Call **General system parameters** menu



Call **printer and save parameters settings** menu [5.1].



Setup beeper

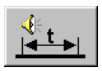
The beep function is active when the FB is shown depressed. Push the THB to change the status (cyclical mode).



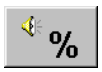
Beep for each keystroke on internal keyboard



Beep for each keystroke on external keyboard



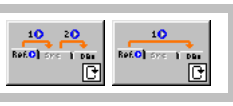
Beep each time the time base starts.



Beep each time a new error value will be displayed



Exit and accept settings, back to calling menu.



Menutab selection mode

Toggle mode between.



Change between activ and inactiv menu cards (MC) with help of change left/right THB.



Change between activ menu cards (MC) with help of change left/right THB

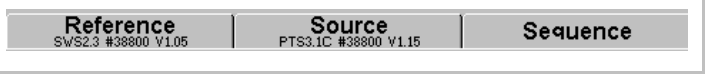


Basic Control Mode

Cyclical mode selection between:



Test System



Reference standard (Ref), source (Src) and automatic test sequence function (Seq) are active. The source settings (connection mode, current connectors used, range selection) are coupled with the reference standard settings. The source controls these reference standard settings.



Reference + Source



Reference standard (Ref) and source (Src) are operated independently. The settings (connection mode, current connectors used, range selection) must be made separately for both units.



Reference

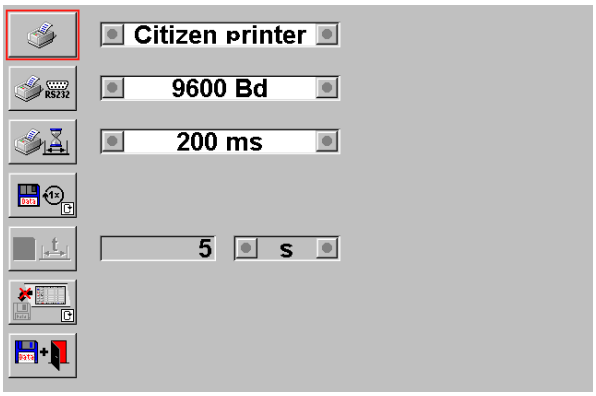


The Reference standard (Ref) is enabled only. The source (Src) is disabled. In this mode the PTS 3.1 C can be used like a standalone reference standard.



Save and exit the menu

5.1 Printer and save parameter settings



Printer and save parameter settings menu
The following settings are displayed:

- printer type
- Baud rate for printer interface 9600Bd
- time for line delay 200ms
- time for save interval not selected

Selection of printer type

The mentioned printer types CITIZEN PD-04 and DATAMEGA DPN-2335-40-V.24 are tested. Other printer types have to be tested before use. The printer should be connected to the serial interface.

Citizen printer	Selection for the thermo printer CITIZEN PD-04
Epson printer	Selection for the dot matrix printer DATAMEGA DPN-2335-40-V.24
No printer	Selection without any printer.

Set printer baudrate

The printer baudrate is set separately. So as soon as the printer is used this settings will be active independent from the settings of the RS232 interface in data base installation submenu.

9600 Bd	The following settings can be selected: 4800 / 9600 / 19200 / 38400 / 57600 / 115200 Baud.

Set Printer line delay

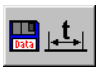
200 ms	The line delay time can be selected: 200ms / 500ms / 1000ms / 2000ms or OFF.

Set save mode

Toggle mode between the two save modes.

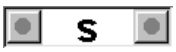
The results will be saved one time. The FB interval with the according input field is ‘grayed out’

The results will be saved at the defined interval time. This mode will be used for load analysis.





Input of number between 1 and 99999



Select s, min or hr

h: hour, m: minute, s: second

Indication of active periodical save mode



The camera key is shown depressed



The CF card status indication is periodically changing between diskette symbol and size indication. The background becomes temporary red, when data is saved to the CF card.

To stop the periodical saving the camera key must be pressed once again.

Set image save mode

If activated, an image of the display at time of pressing the camera FB can be saved together with the actual result data set.

Toggle mode between.



Save display image

The whole display content is saved



Save results image

The result window of the display is saved



No image

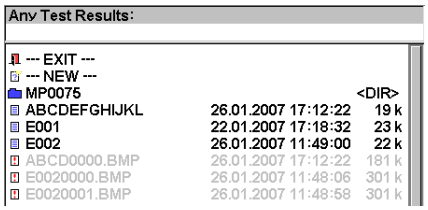
The image save function is disabled.

The images are saved in the same directory as the result file in the format:

<4 char name><4 digit number>.BMP

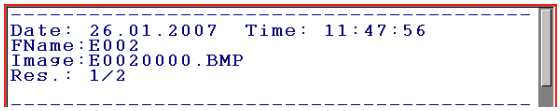
<4 char name>	First 4 characters of the result file name
<4 digit number>	Automatically incremented number starting at 0000
.BMP	Windows BMP Bitmap File Format

Example



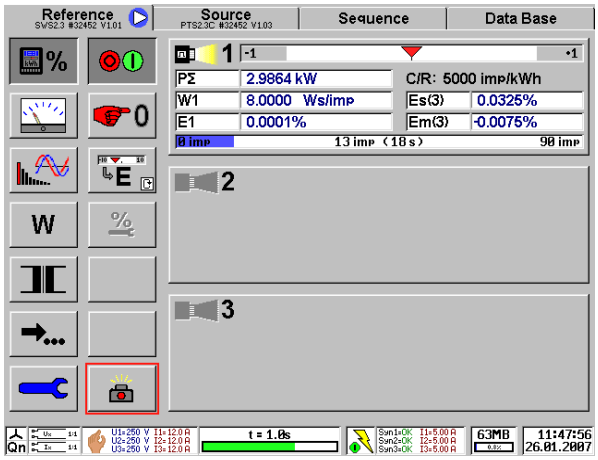
Result directory

Result files and image files are stored in the same directory. The grey shown image files *.BMP cannot be viewed on the instrument itself with the result preview function.
If a result file is deleted, then also all linked image files are deleted.



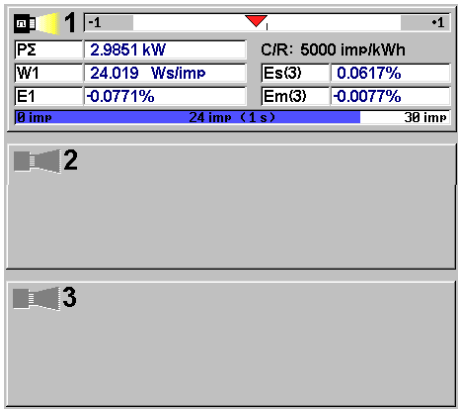
Header of results at print preview

The link between result file (E002) and image file (E0020000.BMP) is shown.



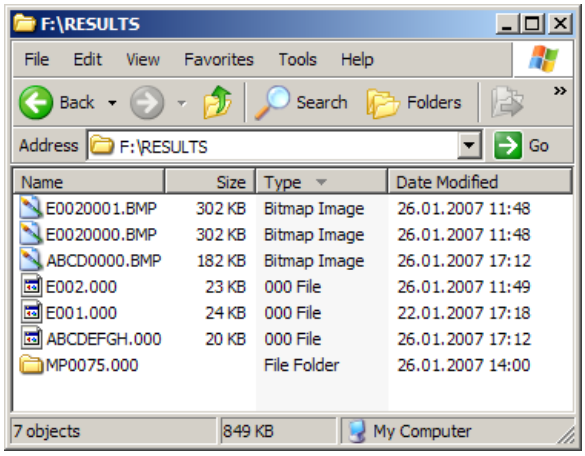
Display image

The full display is saved (size 302 kB). The image E0020000.BMP was captured together with the results (same time and date in status as in header of results).



Result image

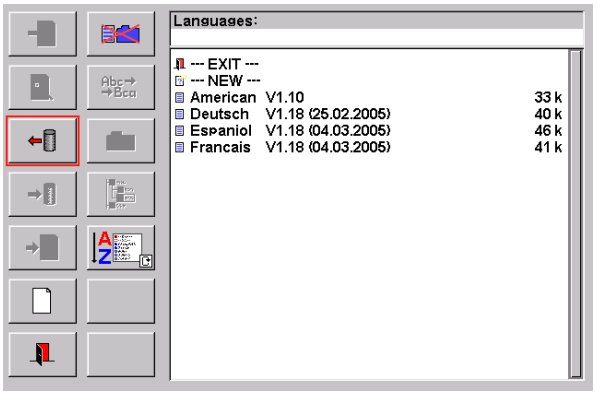
Only the result section of the display is saved (size 182 kB).



Directories on CF card

The images are stored in the directory **RESULTS**.
The images can directly be accessed by the PC with a CF card reader. The images can be copied or moved to any directory on the PC and can be used for documentation of the measurements (e.g. inserted in a word document).

5.2 Language Selection



Language selection menu
The available languages for tool tips and menu texts are displayed in this menu

There are two possibilities to load new language files to the instrument:

- Download of a new language file **<language>.txt** from a PC with the download tool.
- Copy the new language file **<language>.LNG** on a PC directly to the compact flash card directory **LANGUAGE.DB**.

For use of standard FB for data base handling see [6].

	Select language file



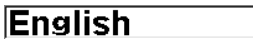
One of the shown languages can be selected.
The selected language will be activated immediately.



The selected language is indicated in the menu Parameter.

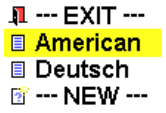
	Reset to default language

The language file <English> will be loaded.

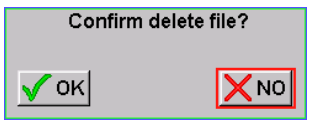


The language English is indicated in the menu Parameter.

	Delete file



Select the file.



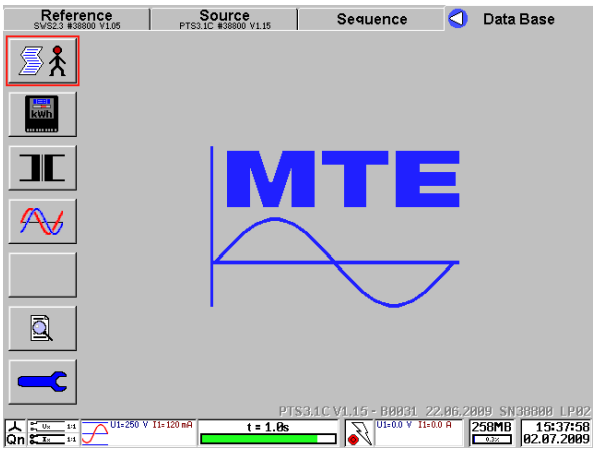
By answering the security question with OK the marked file will be deleted.



New language selection

	Exit and accept settings, back to calling menu.

6. Data Base Test results and administrative data

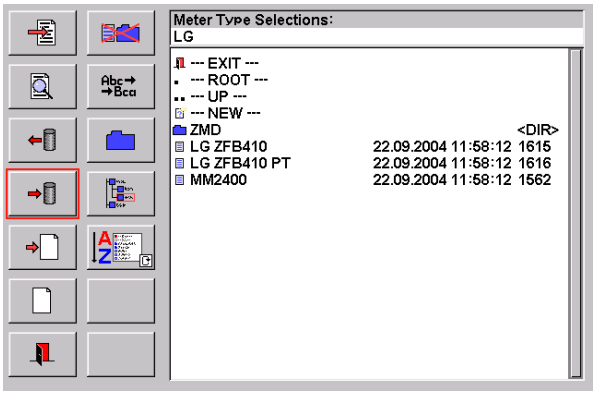


Data Base menu card
The data base menu gives access to all administrative data sets (ADS) and test results dataset (TDS), which are saved on the compact flash card.
Parts of the data base can either be entered or modified manually with the keypad or external keyboard or can be loaded into the unit with the software CALSOFT. Data transfer from PC to the compact flash card can be done via the serial interface or directly with an adapter for the compact flash card connected to the PC.
Access to parts of the data base is possible from different menu cards and sub menus.

Indications / settings

	Call **Administrative data** menu [6.4]
	Call **Meter data** menu [6.5]
	Call **Transformer data** menu [6.6]
	Call **Load point data** menu [6.7]
	Call **View test results** menu [6.2]
	**Basic settings of the instrument** see chapter [5]

6.1 Data Base functions



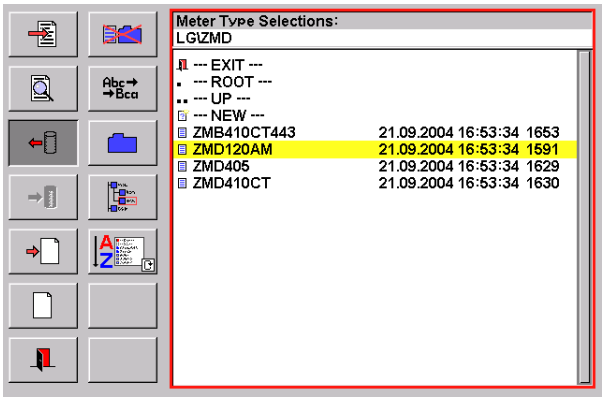
Data base file selection menu
The window on the right side shows a directory (e.g. Meter Type Selections) with subfolders and object files. There exists several object file types for the different parts of the data base.
The two FB columns at the left side show all the available data base functions, which can be applied on the object files.
The object file selection menu can be called from different MCs and different locations. If some FB's are not used at a call of the object file selection menu, they are shown "grayed out" and are not accessible in this case.

Indications / settings



Basic file handling functions

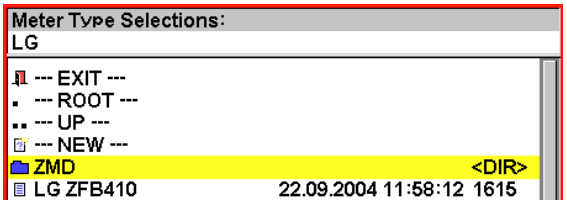
Common functions for the listed FB's (example shown for load object file)



Activate function
Select and activate FB with push on THB. The FB is shown depressed. A red frame surrounds the file window and a yellow selection line is shown.



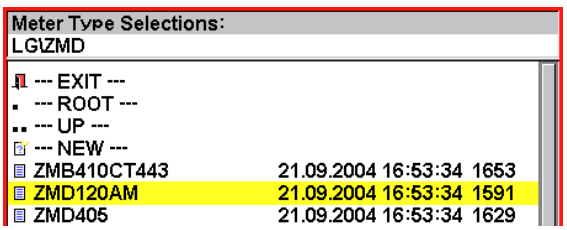
Move the yellow selection line up / down by turning the THB right / left.



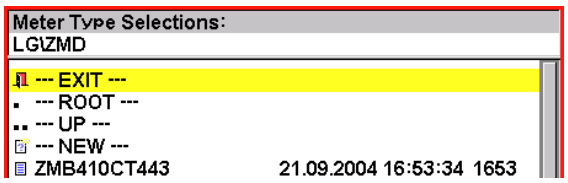
Activate subfolder
Move yellow line by turning the THB to desired folder name and push THB to change to selected folder. The path with root directory (Meter Type Selections:) and subfolders (LG\ZMD) is shown in the two header lines.

Higher folder levels can also be selected with --- UP --- or --- ROOT ---, see description under browse.

Note: Direct selection of folders is not working for delete and rename. Here the browse function must be used.



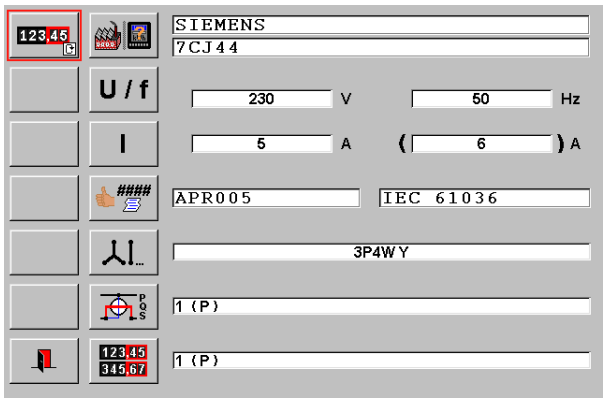
Select file
Move yellow line by turning the THB to the desired file (e.g. ZMD120AM for load or ---NEW--- for save).



Cancel function
Move the yellow line to EXIT and push THB to cancel the function.

Edit actual object

The editor menu of the object file type indicated in the root directory (e.g. Meter Type Selections) is displayed.



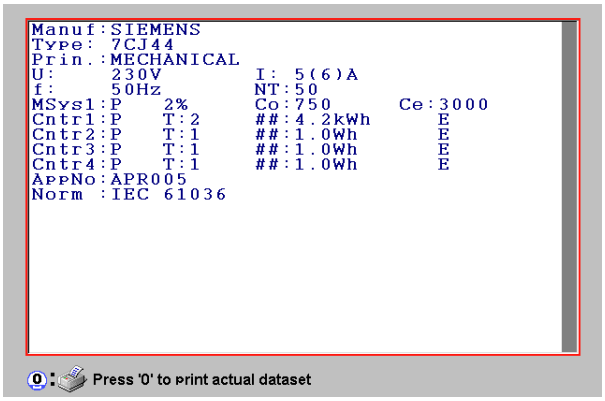
Actual meter type dataset
The actual content of the object can be viewed and changed directly.
The content of the entry fields depends on the forgoing actions.
If an object was loaded before, the content of this object file is shown.
If reset object to defaults or create / edit new object was called before, the fields are empty.
Some fields can directly be changed (e.g. manufacturer: SIEMENS), other fields contain links to sub menus (e.g meter counter setup: 1 (P)) or show object file names of linked object files.

Exit, back to file selection menu.

Note: To keep the changes, they must be saved, after leaving the menu, otherwise they will be lost at next power off.

View actual object

The content of the actual object dataset of the file type indicated in the root directory (e.g. Meter Type Selections) is displayed in the printout format.



View actual meter type
The data of the actual object is shown in the printout format.
This function gives a good overview over the actual object dataset, because all data, also the data of the linked submenus and object files, is shown at once.



Scroll up / down by turning the THB at big datasets

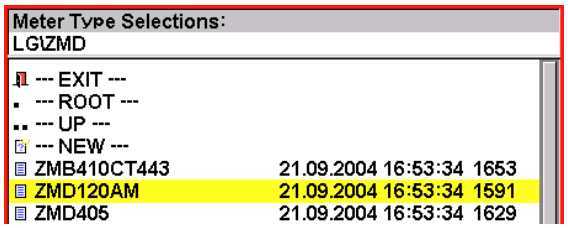


Exit menu by push on THB



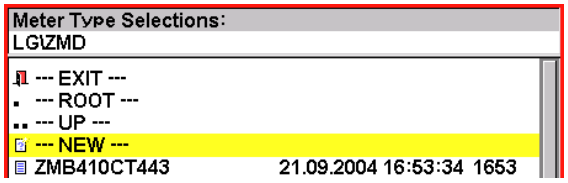
Print results by push on zero key [10.3]

Load object file

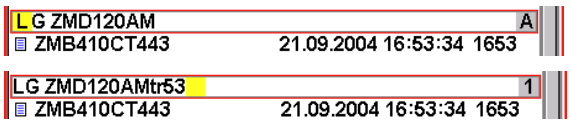


Load selected object file
Push THB at selected object file (e.g. meter type file ZMD120AM in subfolder path: LG\ZMD of root directory: Meter Type Selections).
The file is loaded and the editor of the actual object dataset is shown (see description for edit actual object).

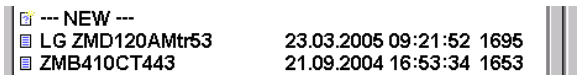
Save object file



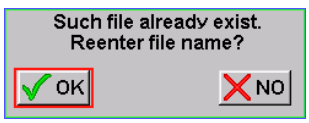
Save as new file
Select line ---NEW--- and push THB to save dataset as new file.



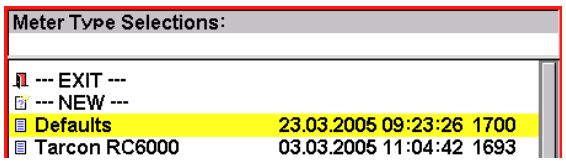
Enter / change name
The input of a name is required.
In some cases a name is automatically generated. The name can be changed with THB and keypad [4.3.2].

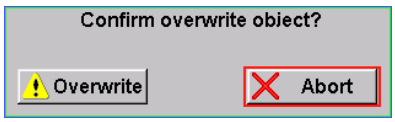


Terminate save
Push THB to terminate the save function.



Warning file exists, reenter name?
OK: Reenter different file name and push THB again to terminate.
NO: The rename function is canceled.



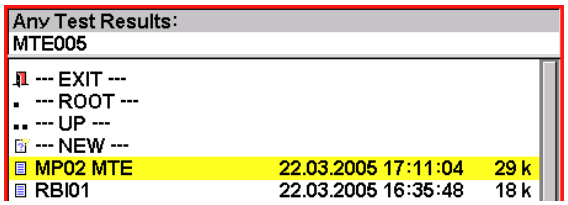


Save as defaults
Select file named Defaults in root directory (e.g. Meter Type Selections) and push THB. A confirmation is required, because an existing file will be overwritten.

Confirm overwriting

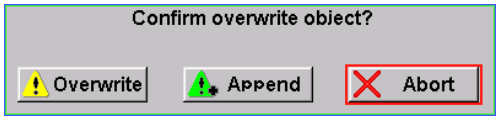
Overwrite: Overwrite Defaults with new settings. At next power on this settings will be loaded as default. The save function is terminated.

Abort: Cancel save function. The actual defaults settings remain unchanged.



Save to existing result file

With this function several measurement data sets can be saved in the same result file.

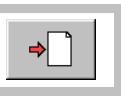


Confirm overwriting / append

Overwrite: The old measurement data set will be overwritten with the new data set.

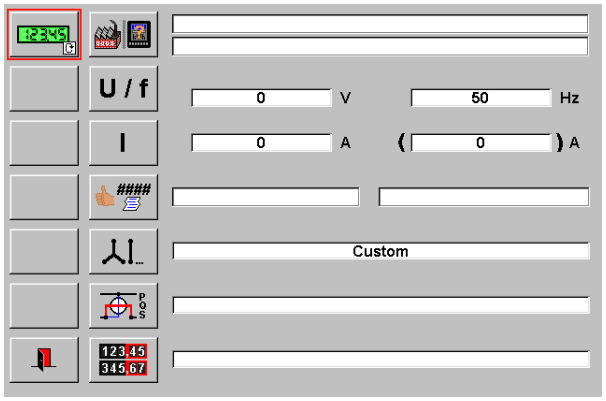
Append: The new measurement data set will be appended to the existing file. This option is only available at measurement result files.

Abort: Cancel save function.



Create / edit new object

The empty editor menu of the object file type indicated in the root directory (e.g. Meter Type Selections) is displayed.

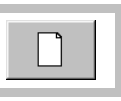


Actual meter type dataset - empty
The input fields are empty or reset to default values.
Enter new dataset as desired. See description of different actual object datasets for the meaning of the listed entry fields.

Exit, back to file selection menu.

Save the values entered at the actual object dataset to a file in the data base (optional)

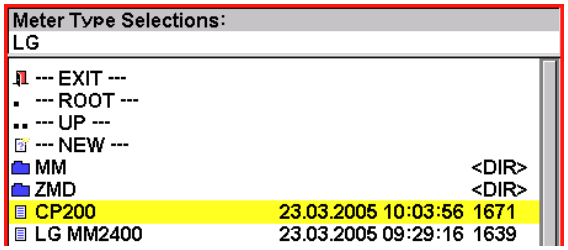
Note: If the entries are not saved, they will be lost at power off.



Reset actual object to defaults

The actual object dataset is cleared. All entry fields and links to submenus and other object files are empty.

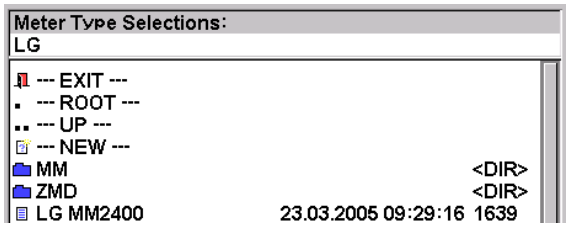
Delete object file or folder



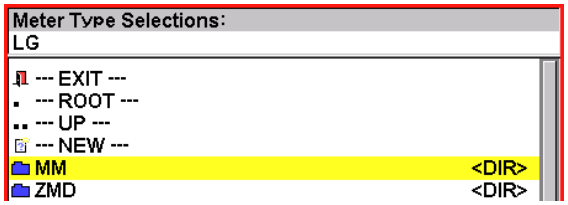
Delete object file
Push THB at selected file.
A confirmation is requested.



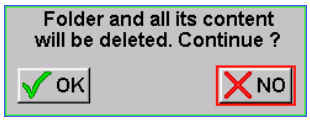
Confirm delete file
NO: The delete function is canceled.



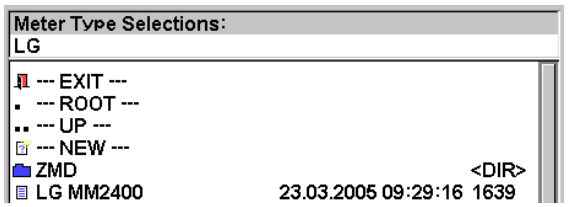
OK: The file is deleted and the delete function is terminated.



Delete folder
Push THB at selected folder. A confirmation is requested.

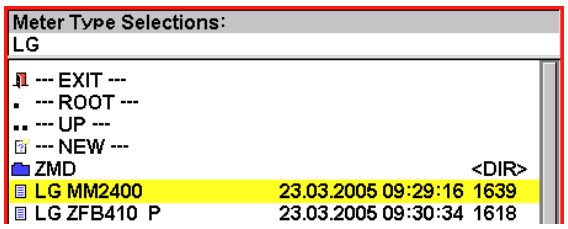


Confirm delete folder
NO: The delete function is canceled.

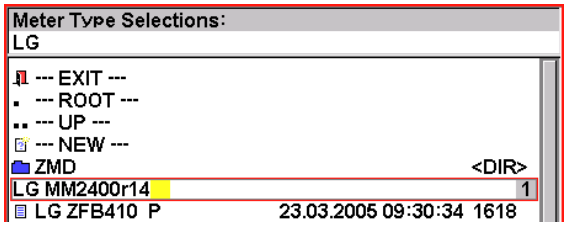


OK: The folder and all its content (files and subfolders) are deleted. The function is terminated.

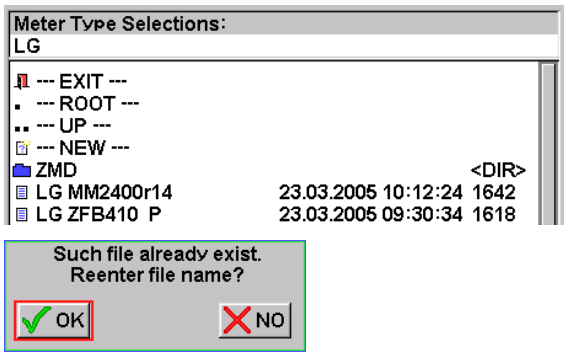
Rename object file or folder



Activate rename
Push THB at selected file or folder.



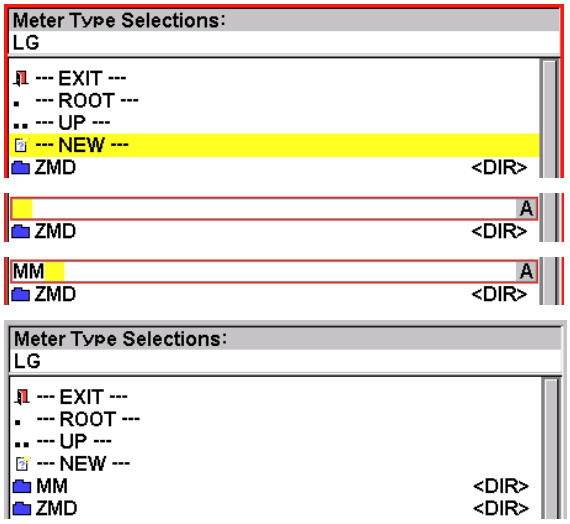
Change name
Change name with THB and keypad [4.3.2].



Terminate rename
Push THB to terminate input and rename function.
If the name was not changed a warning appears.

Warning file exists, reenter name?
OK: Reenter different file name and push THB again to terminate.
NO: The rename function is canceled.

Create subfolder

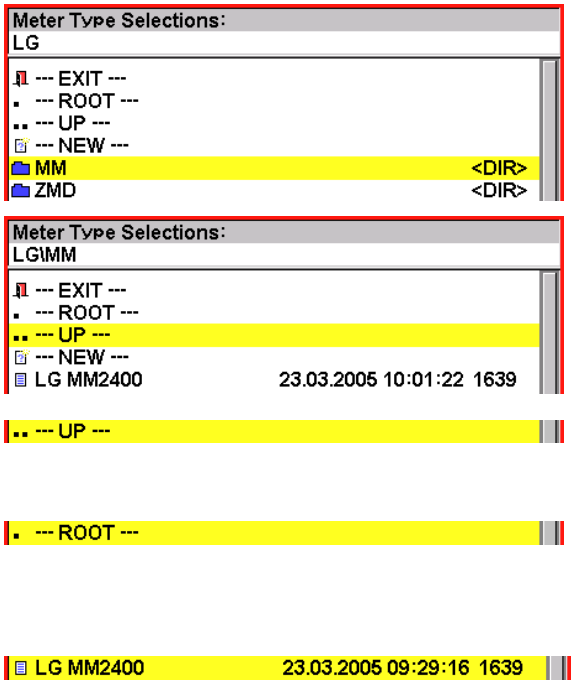


Select / activate new
Select line ---NEW--- in the root directory or subfolder, where the new subfolder shall be created, and push THB to start input of name.

Enter subfolder name
Enter name of subfolder (MM) with THB and keypad [4.3.2]

Terminate function
Push THB to terminate input and create new folder (MM). The function is terminated.

Browse subfolders



Select subfolder
Select folder (MM) in actual path (LG) with yellow line and push THB to activate the folder.

Change to subfolder
The subfolder content is shown. The second header line shows the new path (LG\MM).

Change to upper folder
Select --- UP --- and push THB to change to next higher level.

Change to root directory
Select --- ROOT --- and push THB to change to the root directory (e.g. Meter Type Selections)

Terminate browse
Pushing the THB at any line with a file name or --- NEW --- or --- EXIT --- terminates the browse function.



Change sorting order

Push on THB to cyclically change between the 7 different sorting orders:



Sort directories followed by files ascending according names.



Sort files followed by directories descending according names.



Sort files and directories ascending according creation dates



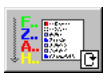
Sort files and directories descending according creation dates



Sort files ascending according file size



Sort files descending according file size

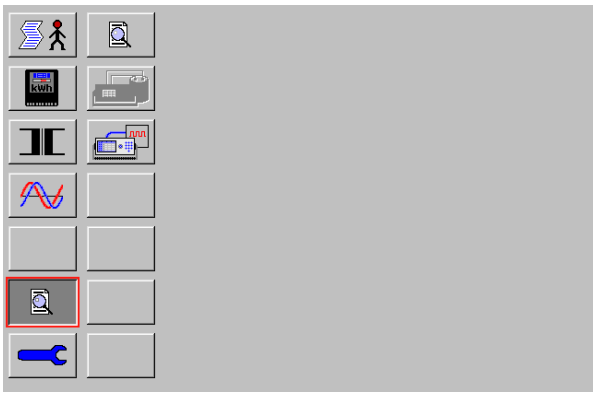


No sorting



Exit, back to calling menu

6.2 View of saved test results and measurement information



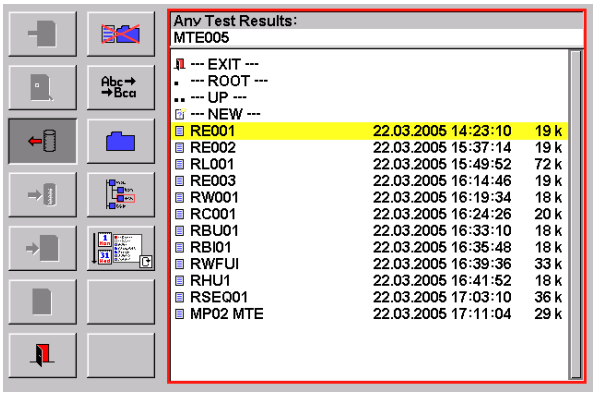
View results menu

Call **Any Test Results** directory

Call **URef Test Results** (not available)

Call **FRef Test Results** directory

Following some examples of viewing the results saved in the **Any Test Results** directory are shown. The results of the other directories **URef Test Results** and **FRef Test Results** can be viewed in the same way.

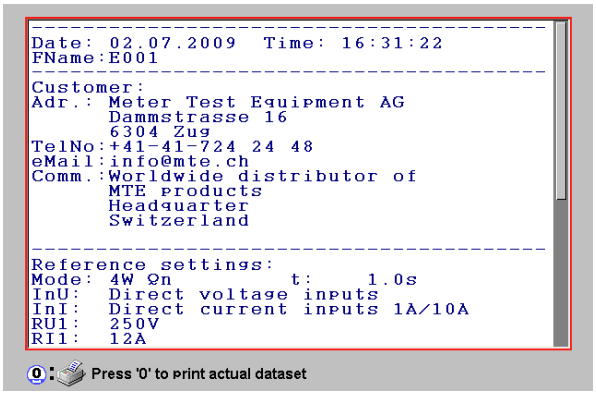


Any Test Results directory

All standard result files saved on the compact flash card are listed in this directory. The result files contain the combined results data with test results data (TDS) and administrative data (ADS).

Select / load a result file

The view results menu is called



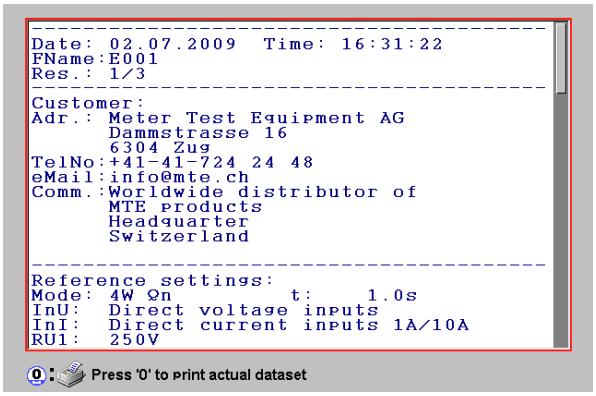
View results menu

The results are shown in the printout format. This allows a compact fast overview of the ADS and TDS data saved in a result file
The first line shows the result file name. The second line shows date and time of saving.

Scroll up / down by turning the THB at big datasets

Exit menu by push on THB

Print results by push on zero key [10.3]



Result file with several data sets

In a result file with several data sets saved in continuous mode or with the append function the actual shown result dataset 1 of total 3 (1/3) is indicated as third header line.

For the look of the different results see printout examples in chapter [10].

6.3 Data Base structure

Stored measuring data [Result] contains two major parts:

- Administrative Dataset (ADS) [Result (Administration)]
- Test Results Dataset (TDS) [Result (Measurement)]

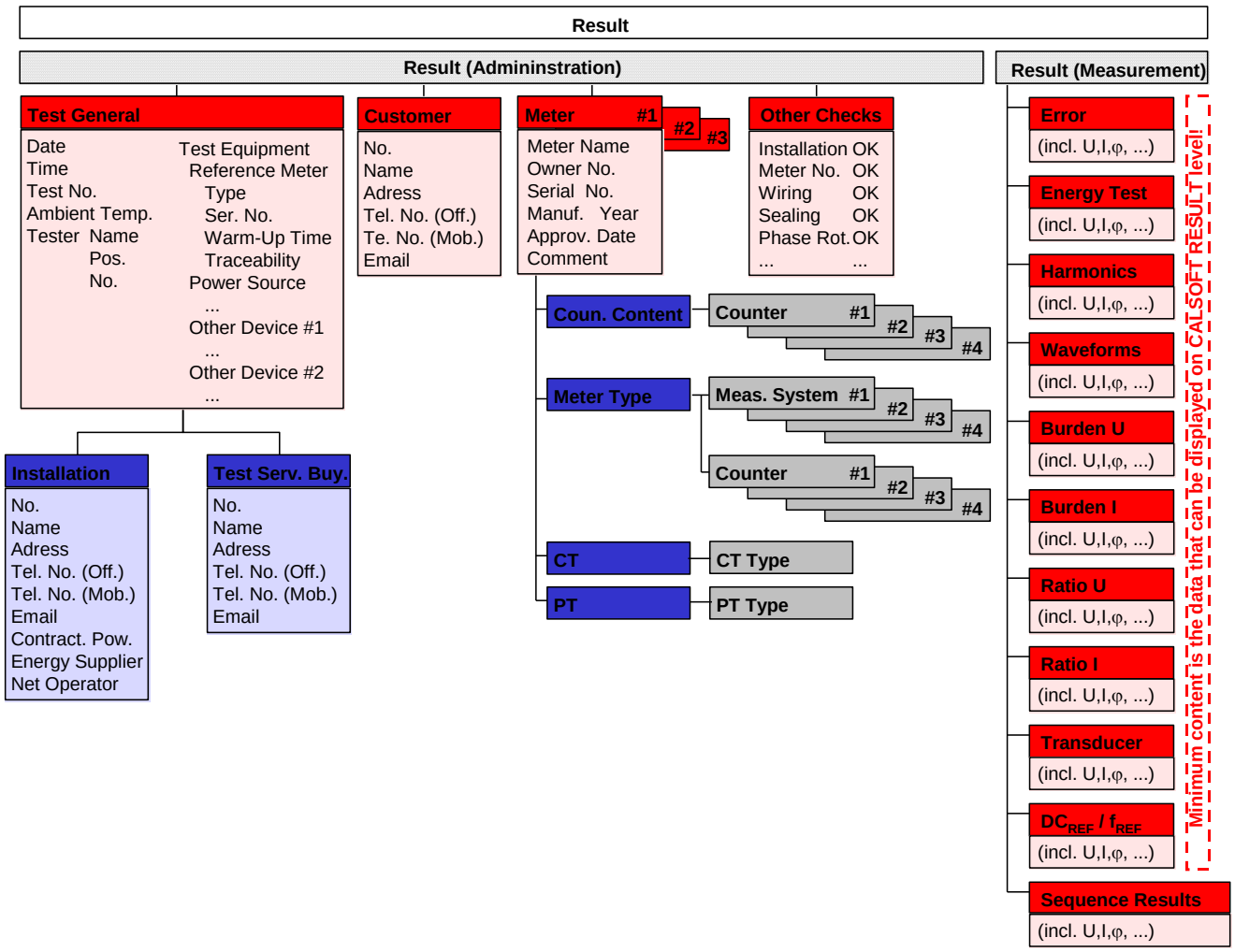
The ADS contains the main parts:

- General Info dataset [Test General]
- Customer dataset [Customer]
- Meter dataset [Meter #1 to #3]
- Other checks dataset [Other Checks]

The TDS contains the parts:

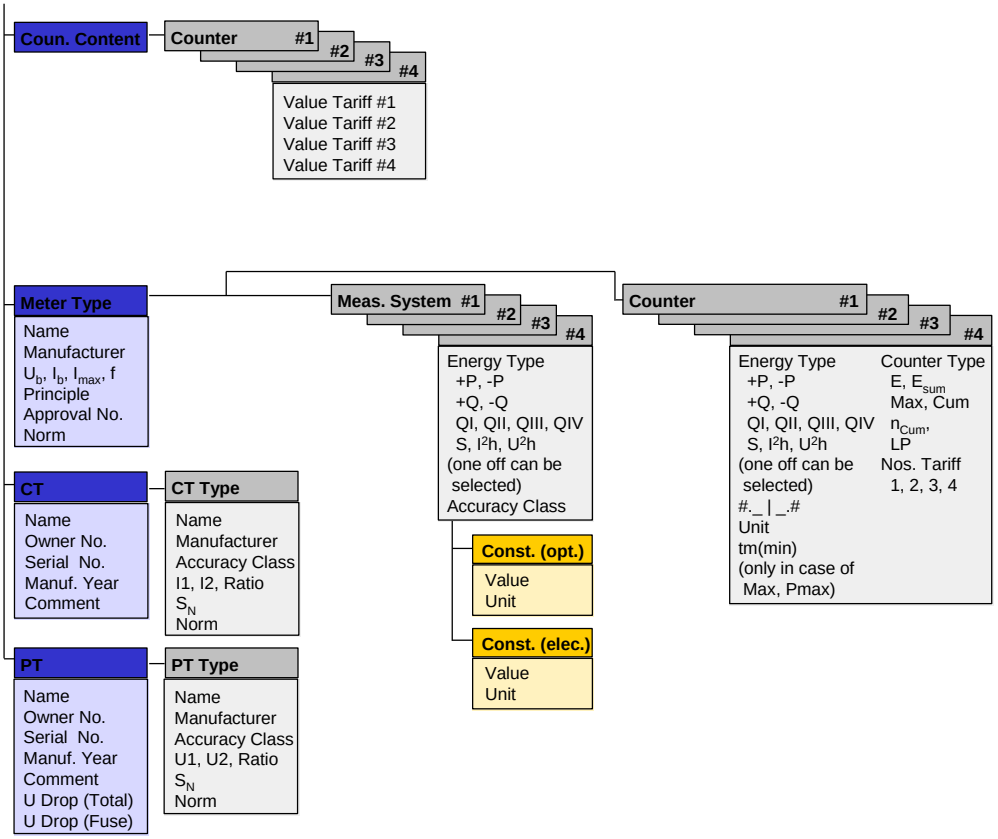
- Results of the different measuring functions [Error] to [DCREF / fREF]
- Sequence results [Sequence Results]

Database structure

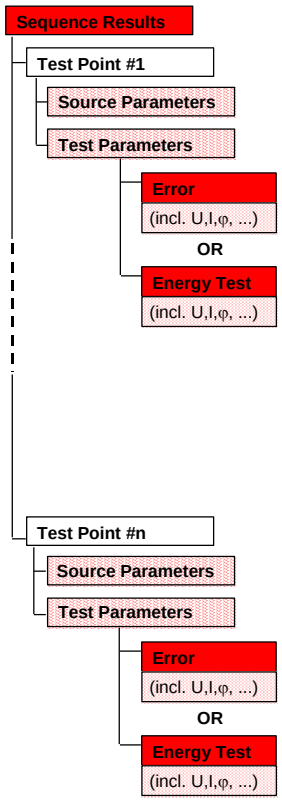


Detail structure

Meter



Sequence results



6.4 Administrative data



Administrative data menu

Administrative dataset (ADS)

The ADS is at the top of the hierarchy of the data base objects. It contains the objects:

- Customer dataset
- General info dataset
- Meter dataset
- Other checks dataset

An ADS object can be linked to a test result data set (TDS) and be saved together with the results as a result file.

Indications / settings

	Load / edit object files

The file selection menu [6.1] is called and an object file directory is displayed:

FB	Directory	Description
	Select Admin Dataset	[6.4.1]
	Select Customer Dataset	[6.4.2]
	Select General Info Dataset	[6.4.3]
	Meter selections	[6.5.2]
	Select Other Results Dataset	[6.4.4]

Three ways to load / edit object files

	Load object file from **directory**

The actual object menu shows the content of the loaded object file, which can be modified.

	Edit actual object

The actual object menu shows the already existing object file, which can be modified.
Operating the edit actual object FB through several levels allows to completely enter new object data with the keypad or an external keyboard or to modify a previously loaded object.

	Create new object

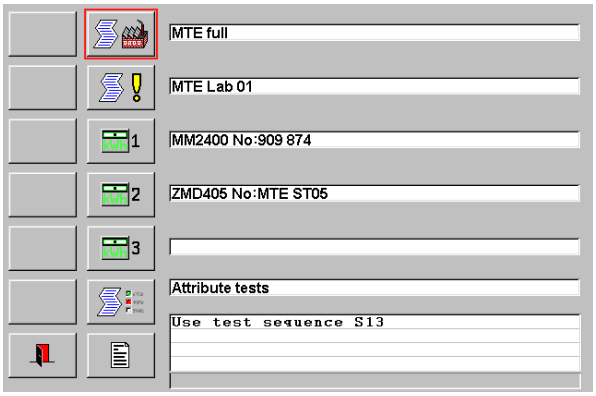
The actual object menu is empty. A completely new object can be entered.

	Save object file

Save modified actual object to new file or overwrite existing file.

6.4.1 Admin dataset (ADS)

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual admin dataset (ADS)
The file names of the actual loaded data base elements are shown at:

- Customer dataset
- General info dataset
- Meter dataset for inputs 1 to 3
- Other checks dataset

Enter or modify directly with THB and keypad or external keyboard:

- Comment to ADS dataset

Indications / settings

	Load / edit object files

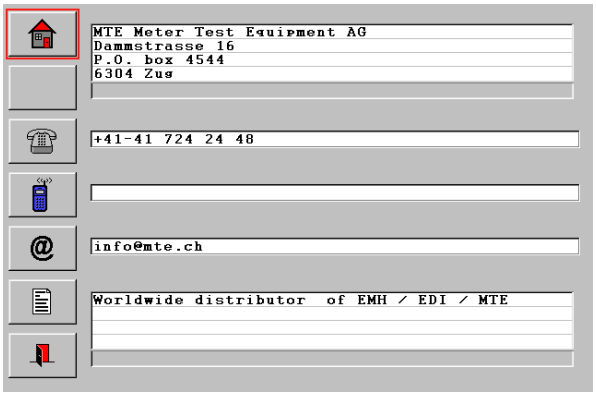
The file selection menu [6.1] is called and an object file directory is displayed:

FB	Directory	Description
	Select Customer Dataset	[6.4.2]
	Select General Info Dataset	[6.4.3]
	Meter selections	[6.5.2]
	Meter selections	[6.5.2]
	Meter selections	[6.5.2]
	Select Other Results Dataset	[6.4.4]

	Exit, back to calling menu

6.4.2 Customer dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual customer dataset
Enter or modify directly with THB and keypad or external keyboard:

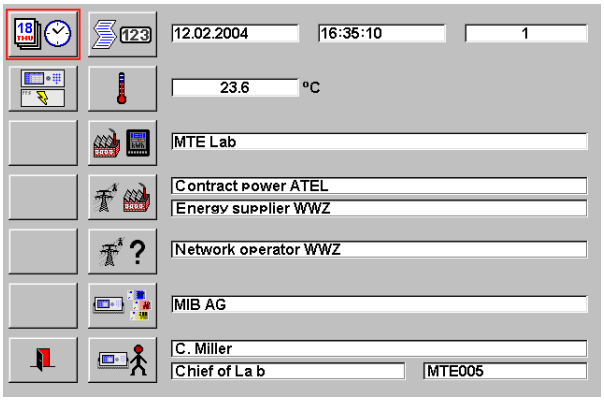
- Customer address
- Phone number
- Mobile phone number
- E-mail address
- Comment to customer dataset

How to make alphanumerical inputs see [4.3].

- Exit, back to file selection menu.

6.4.3 General Info dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual general info dataset
Enter or modify directly with THB and keypad or external keyboard:

- Date / time
- Number
- Temperature
- Contract power / energy supplier
- Network operator
- Name / position / reference of tester

The file names of the actual loaded data base elements are shown at:

- Installation setup
- Test service buyer setup

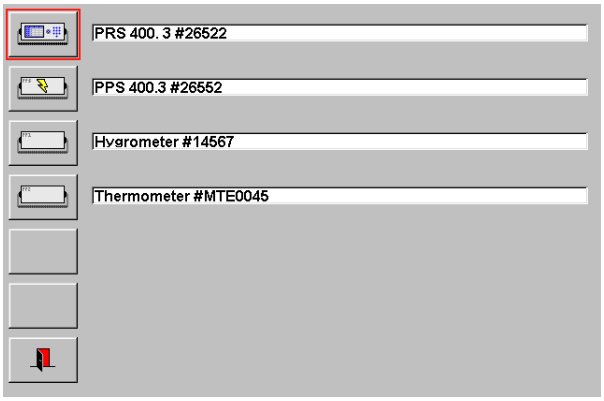
Indications / settings

	Load / edit object files

The file selection menu [6.1] is called with the object file directory:
Select customer Dataset
For description of actual customer dataset object see [6.4.2]

	Call e**quipment info setup** menu [6.4.3.1]

6.4.3.1 Equipment info setup



Equipment info setup menu
The file names of the actual loaded data base elements are shown at:

- Reference meter
- Power source
- Other equipment #1
- Other equipment #2

Indications / settings

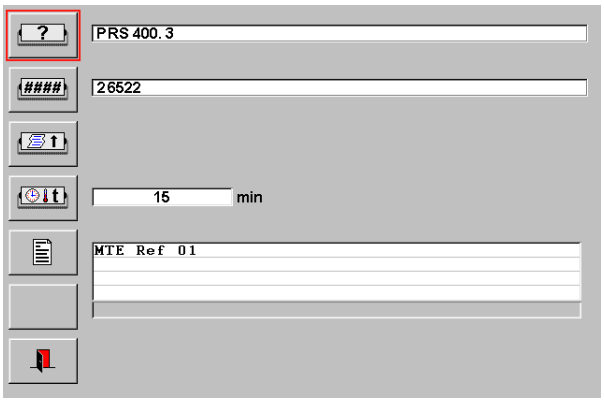
	Load / edit object files

The file selection menu [6.1] is called with the object file directory:
Select Equipment Info Dataset
For description of actual equipment info dataset object see [6.4.3.2]

	Exit, back to calling menu

6.4.3.2 Equipment info dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual equipment info dataset
Enter or modify directly with THB and keypad or external keyboard:

- Equipment type
- Equipment number
- Traceability
- Warm-up time
- Comment to equipment

How to make alphanumerical inputs see [4.3].

	Traceability

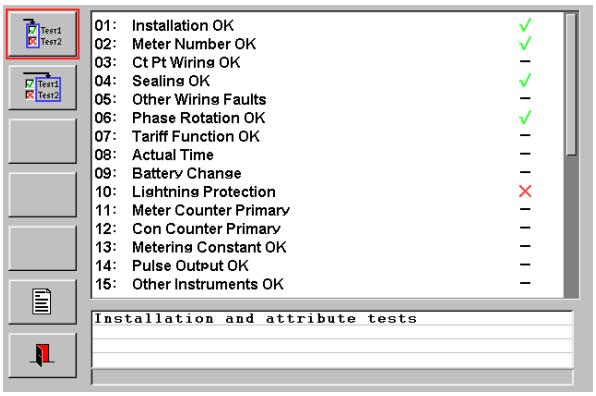
Traceability available

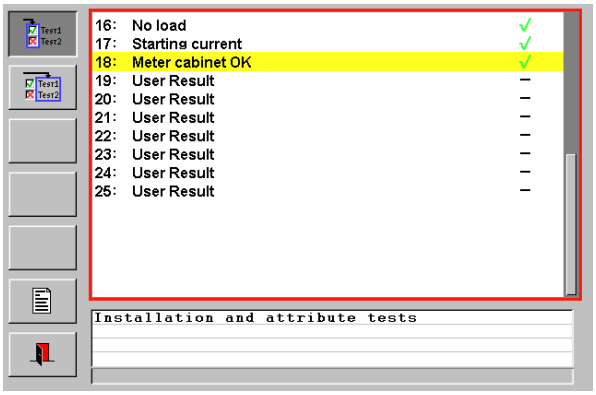
Traceability not available

	Exit, back to calling menu

6.4.4 Other results dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.





Actual other results dataset
A set of predefined (01 .. 15) and user defined checks (16 .. 25) is shown with marking:

- ✓ Good
- ✗ Bad
- — No check

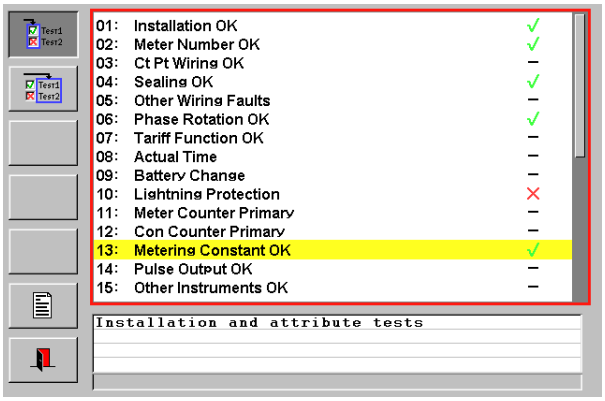
The marking and user defined checks can be modified with:

- Change check boxes
- Define user result

Enter or modify directly with THB and keypad or external keyboard:

- Comment to other results dataset

Change check boxes

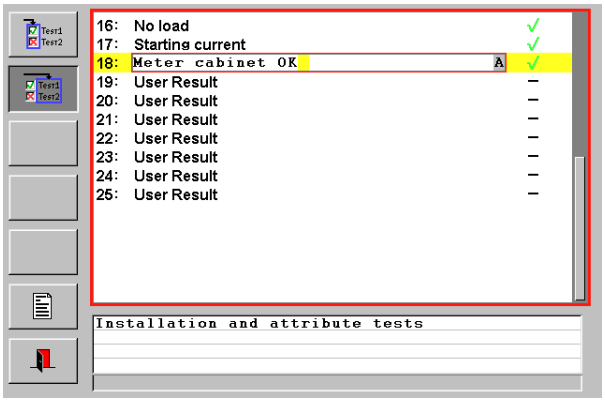


Change checkboxes active
A red frame and a yellow selection row is displayed.
Move the yellow row with the THB on the position to change.
Push on the THB to change the state of the test (cyclical mode):

- ✓ Good
- ✗ Bad
- – No check

Terminate entries by moving the yellow row over the end positions 1 or 25.

Define user result



Definition of user results
The names of the checks at positions 16 .. 25 can be defined by the user.
Move yellow row with THB to position to change.
Activate input of test name with push on THB. Enter test name (e.g. Meter cabinet OK).
Terminate input with push on THB.
Leave definition of user results by moving the yellow row over the end positions 1 or 25.

Exit, back to calling menu

6.5 Meter data



Meter data menu

- Meter type dataset
- Meter dataset

Indications / settings

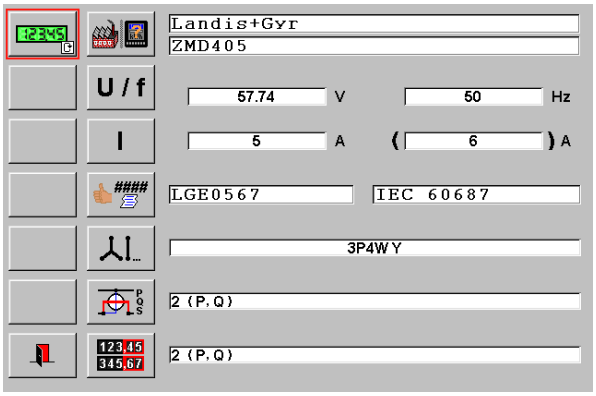
	Load / edit object files

The file selection menu [6.1] is called and an object file directory is displayed:

FB	Directory	Description
	Meter Type Selections	[6.5.1]
	Meter Selections	[6.5.2]

6.5.1 Meter type dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual meter type dataset
Enter or modify directly with THB and keypad or external keyboard:

- Meter principle
- Manufacturer / type
- U / f Nominal voltage / nominal frequency
- I Basic current / maximum current
- Approval Number / meter norm
- Meter connection type
- Measure system setup
- Meter counters setup



Meter principle



Electronic meter



Ferraris meter



Manufacturer / type

Manufacturer
The first line is reserved for name or abbreviation of meter manufacturer
Type
The second line is reserved for name of meter type.



Nominal voltage / nominal frequency

Nominal voltage
Enter nominal voltage as indicated on the meter or the specification.
U (phase - neutral) or U(phase - phase) must be entered depending on meter connection type.
Nominal frequency
Enter nominal frequency as indicated on the meter or the specification.



Basic current / maximum current

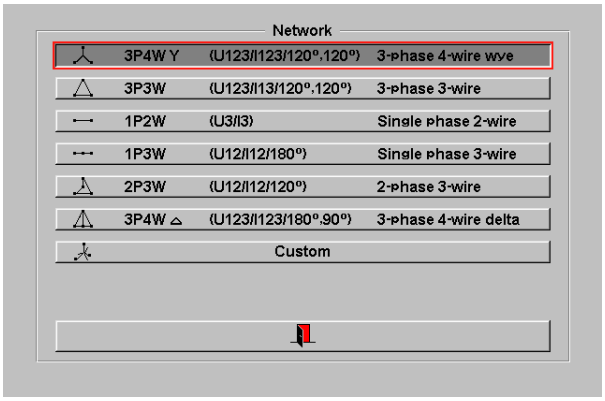
Basic current
Enter basic current Ib at direct connected meters or nominal current In at transformer connected meters, as indicated on the meter or specification.
Maximum current
Enter maximum current as indicated on the meter or the specification.



Approval number / meter norm

Approval number
Any alphanumerical approval identification, defined by customer, country of manufacturer, based on accepted type tests
Meter norm
Customer specific, national or international norm (e.g international meter norm IEC 60687 for electronic meters of class 0.5s, 0.2s).

Meter connection type



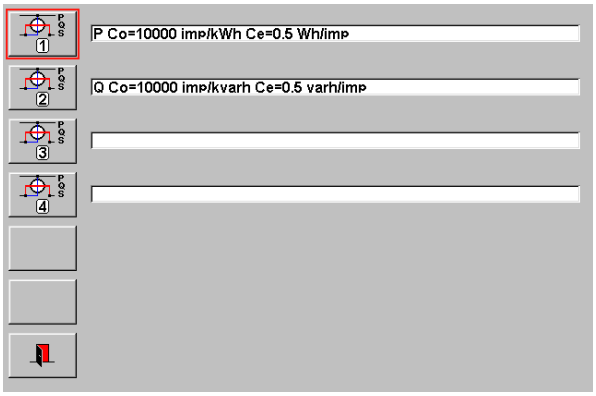
Network type selection menu
Move red selection frame with THB to desired network type. Push THB to activate network type. The selected network is shown pressed.
Push THB on exit door to leave the selection menu.

Call **Measure systems setup** menu [6.5.1.1]

Call **Meter counters setup** menu [6.5.1.3]

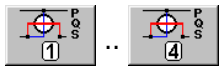
Exit, back to calling menu

6.5.1.1 Measure systems setup



Measure systems setup menu
Up to four measure systems can be defined for one meter type.
The names of the actual loaded data base object files are shown at:

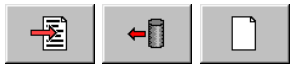
.. Measure system 1 .. 4

	**Load / edit object files**

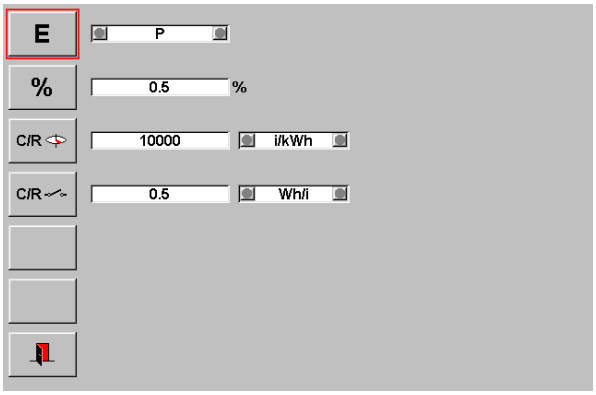
The file selection menu [6.1] is called with the object file directory:
Measure System Selection
For description of actual measure system dataset see [6.5.1.2]

	**Exit, save actual settings, back to calling menu**

6.5.1.2  Measure system dataset

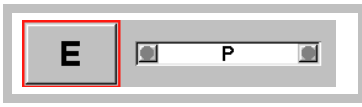


Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual measure system dataset
Enter or modify directly with THB and keypad or external keyboard:

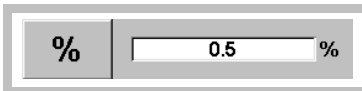
- E — Measuring system type
- % — Accuracy class
- C/R — Meter constant of disc mark / LED
- C/R — Meter constant of electrical output



Energy type

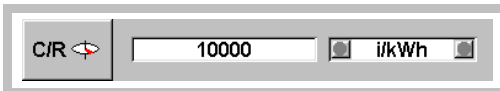
Select energy type with THB (cyclical mode):

P	Active energy import / export
Q	Reactive energy import / export
S	Apparent energy import / export
P+	Active energy import
P-	Active energy export
Q+	Reactive energy import
Q-	Reactive energy export
Q1	Reactive energy in power quadrant I (P+Q+)
Q2	Reactive energy in power quadrant II (P-Q+)
Q3	Reactive energy in power quadrant III (P-Q-)
Q4	Reactive energy in power quadrant IV (P+Q-)
I^2	I^2-hours (used at transformer loss meters, copper and leakage loss)
U^2	U^2-hours (used at transformer loss meters, iron and core loss)

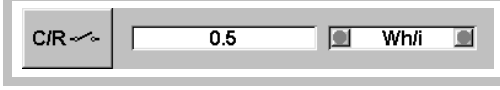


Accuracy class

Enter accuracy class of measuring system in percentage (%) as indicated on meter or specifications.



Meter constant of disc mark /LED impulse output



Meter constant of electrical impulse output

Constant value

Enter constant value for disc mark (1 revolution (r) = 1 impulse (i)) or LED impulse output or electrical impulse output as indicated on the meter or specifications.

Unit

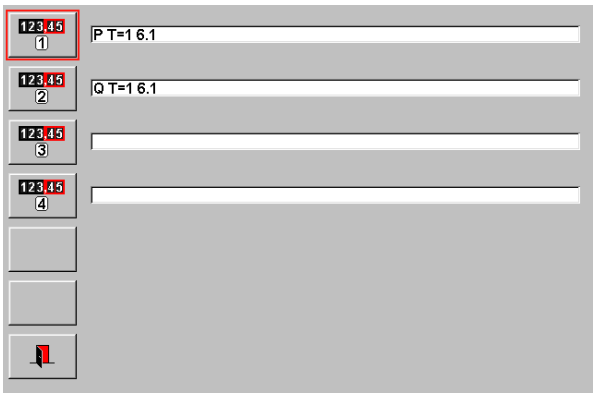
Available units depending on selected energy type

	P..	**Q..**	**S..**	**U^2**	**I^2**
i/k..h	i/kWh	i/kvarh	i/kVAh	i/kWh	i/kWh
i/..h	i/Wh	i/varh	i/VAh	i/Wh	i/Wh
i/..s	i/Ws	i/vars	i/VAs	i/Ws	i/Ws
k..h/i	KWh/i	kvarh/i	kVAh/i	KWh/i	KWh/i
..h/i	Wh/i	varh/i	VAh/i	Wh/i	Wh/i
..s/i	Ws/i	vars/i	VAs/i	Ws/i	Ws/i



Exit, save actual settings, back to calling menu

6.5.1.3 Meter counters setup



Meter counters setup menu
Up to four counters can be defined for one meter type.
The names of the actual loaded data base object files are shown at:

.. Counters 1 .. 4

Indications / settings

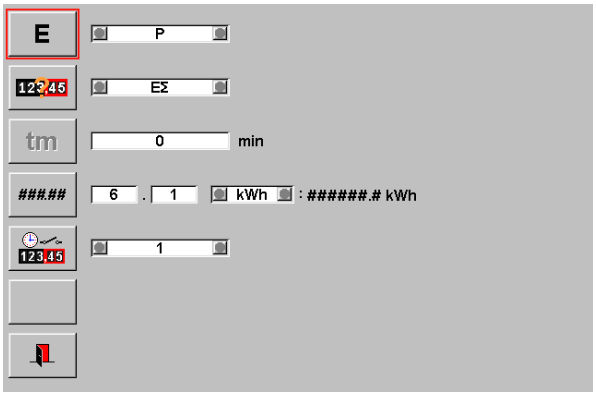
..	**Load / edit object files**

The file selection menu [6.1] is called with the object file directory:
Meter Counter Selections
For description of actual meter counter dataset see [6.5.1.4]

	Exit, save actual settings, back to calling menu

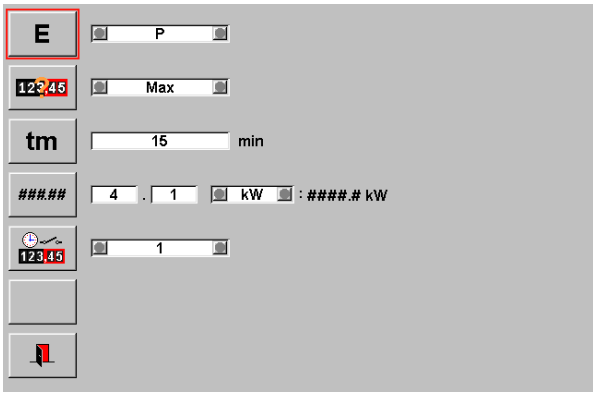
6.5.1.4 Meter counter dataset

Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual meter counter dataset
Energy counter
Enter or modify directly with THB and keypad or external keyboard:

- E — Energy type
- Counter type
- ###### — Register format
- Number of tariffs



Maximum counter
Additional to the energy counter settings define:

tm Maximum period

Indications / settings



Energy type

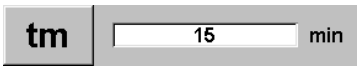
Select energy type with THB (cyclical mode):
P, Q, S, P+, P-, Q+, Q-, Q1, Q2, Q3, Q4, U^2, I^2
Description of energy types see measure systems dataset [6.5.1.2]



Counter type

Select counter type with THB (cyclical mode):

E	Energy
EΣ	Total energy
Max	Maximum
Cum	Cumulative maximum
nCum	Maximum period
LP	Load profile



Maximum period

The FB is only active at counter type Max.
Enter period for maximum register in minutes.



Counter format

Format

X. Digits before decimal point (1 .. 9)

.X Digits after decimal point (0 .. 9)

Unit

Available units depending on counter and energy type

counter types	energy types	units
E, EΣ	P.., U^2, I^2	Wh, kWh, MWh, GWh
	Q..	varh, kvarh, Mvarh, Gvarh
	S	VAh, kVAh, MVAh, GVAh
Max, Cum, nCum, LP	P.., U^2, I^2	W, kW, MW, GW
	Q..	var, kvar, Mvar, Gvar
	S	VA, kVA, MVA, GVA

XXXXXX.X kWh Indication of actual selected register format and unit



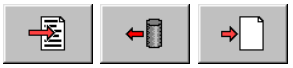
Number of tariffs

Number of tariffs: 1, 2, 3, 4

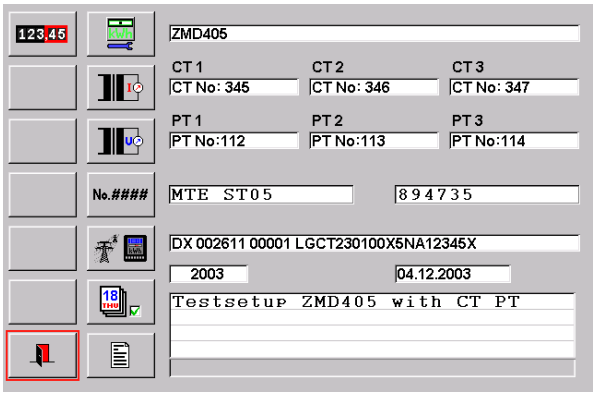


Exit, back to calling menu

6.5.2 Meter dataset



Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual meter dataset
Object files for meter type and transformers (optional) and metering code (optional) can be loaded. The file names of the actual loaded object files are shown at:

- Meter type
- Current transformers CT1 .. CT3
- Voltage transformers PT1 .. PT3

The loaded metering code is shown at:

- Metering code

Enter or modify directly with THB and keypad or external keyboard:

- Owner number / serial number
- Production year / certification date
- Comment to meter dataset
- Counter readings

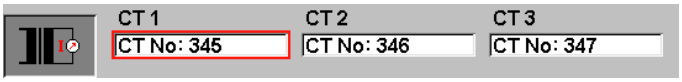
Indications / settings

Load / edit object file

The file selection menu [6.1] is called with the object file directory:

Meter Type Selections

For description of actual meter type dataset see [6.5.1]



Load / edit object files

Up to three current and / or voltage transformers can be linked to the phases 1 to 3 of a meter. In this way a whole substation setup can be defined.

Example for loading of CT

Move red frame with THB to field of phase 1 (CT1). The file selection menu [6.1] is called and an object file directory is displayed.

Select / load file from directory. The object file loaded at phase 1 is automatically copied to phases 2 and 3.

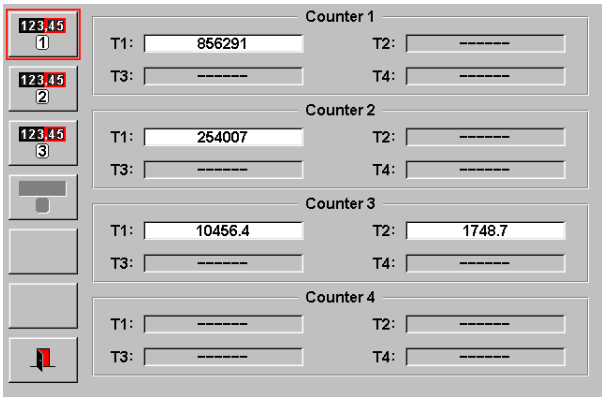
Select fields of phases 2 or 3 with THB to individually load other settings for this phases.

Move red selection frame to FB and push on THB to terminate function.

The number of active input fields is depending on the connection mode defined in the loaded meter type. E.g. at 3-wire mode only 2 input fields are active.

FB	Directory	Description
	CT Selections	[6.6.2]
	PT Selections	[6.6.4]

Enter counter readings



Actual counter readings dataset
The readings of up to 4 tariffs (T1 .. T4) for up to 4 counters can be entered here. Enter or modify counter reading directly with THB and keypad or external keyboard for:

- Counter 1 tariff T1
- Counter 2 tariff T1
- Counter 3 tariff T1, T2

Only tariffs defined in the loaded meter type are shown.

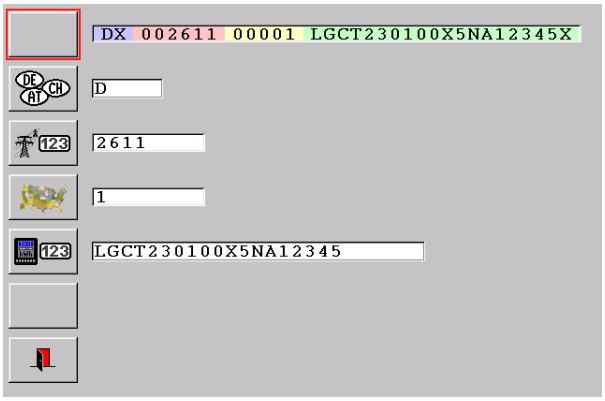
- Exit, back to calling menu

Load / enter metering code

The file selection menu [6.1] is called with the object file directory:
Metering code Selections

Call **Load object file** to load a saved metering code. The meter data set menu is displayed again and the loaded metering code is displayed.

Call **edit actual object** or **create new object** to call the actual meter code dataset menu.



Actual meter code dataset
Enter or modify directly with THB and keypad or external keyboard:

- Country code
- Network operator code
- ZIP code
- Metering code

- Exit, back to calling menu

Exit file selection menu, back to meter dataset menu. The entered metering code is displayed.

Exit, save actual settings, back to calling menu

6.6 Transformer data



Transformer data menu
Object files for current CT and potential PT types and CT / PT transformers can be loaded. The file names of the actual loaded object files are shown at:

- Current transformer CT type dataset
- Current transformer CT dataset
- Potential transformer PT type dataset
- Potential transformer PT dataset

Load / edit object file

The file selection menu [6.1] is called with the object file directory:
CT Type Selections
For description of actual current transformer CT type see [6.6.1]

Load / edit object file

The file selection menu [6.1] is called with the object file directory:
CT Selections
For description of actual current transformer CT dataset see [6.6.2]

Load / edit object file

The file selection menu [6.1] is called with the object file directory:
PT Type Selections
For description of actual potential transformer PT type dataset see [6.6.3]

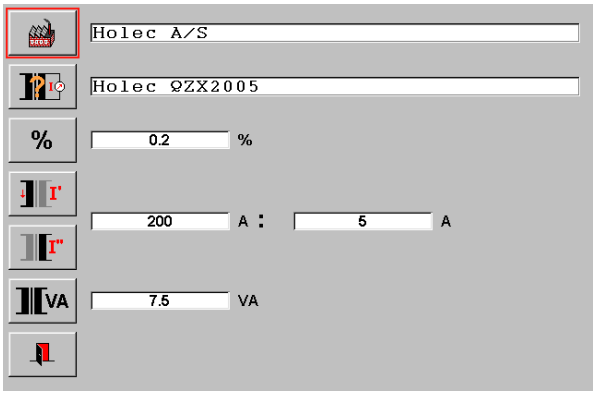
Load / edit object file

The file selection menu [6.1] is called with the object file directory:
PT Selections
For description of actual potential transformer PT dataset see [6.6.4]

6.6.1 Current transformer CT type dataset



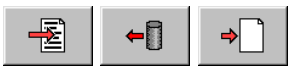
Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



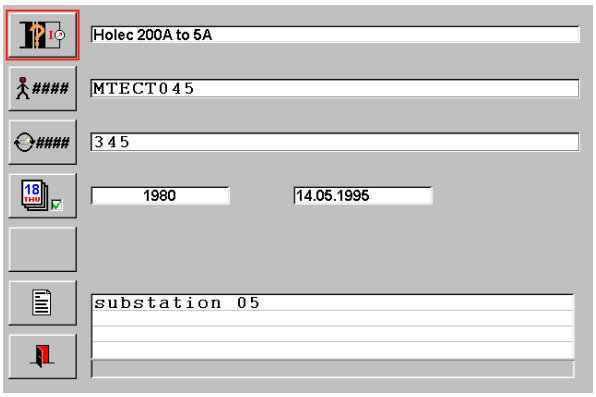
Actual CT type dataset menu
Enter or modify directly with THB and keypad or external keyboard for:

- Manufacturer
- Current transformer CT type
- Accuracy class
- Primary current
- Secondary current
- Nominal burden
- Exit, back to calling menu

6.6.2 Current transformer CT dataset



Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual CT dataset
Object files for current transformer CT's and current transformer CT types can be loaded. The file names of the actual loaded object files are shown at:

- Current transformer CT type

Enter or modify directly with THB and keypad or external keyboard for:

- Owner number
- Serial number
- Production year / certification date
- Comment to CT dataset
- Exit, back to calling menu

Indications / settings

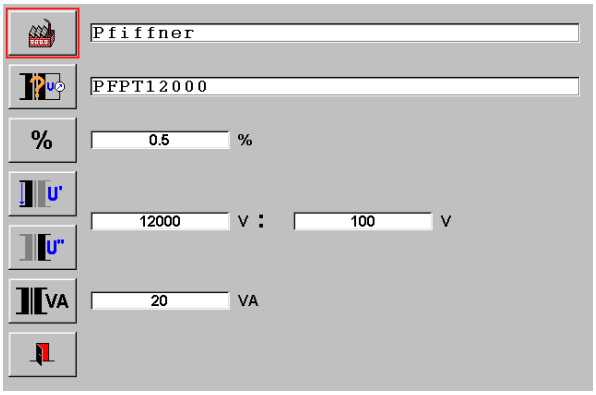
	Load / edit object file

The file selection menu [6.1] is called with the object file directory:
CT Type Selections
For description of actual current CT type dataset see [6.6.1]

6.6.3 Potential transformer PT type dataset



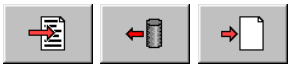
Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



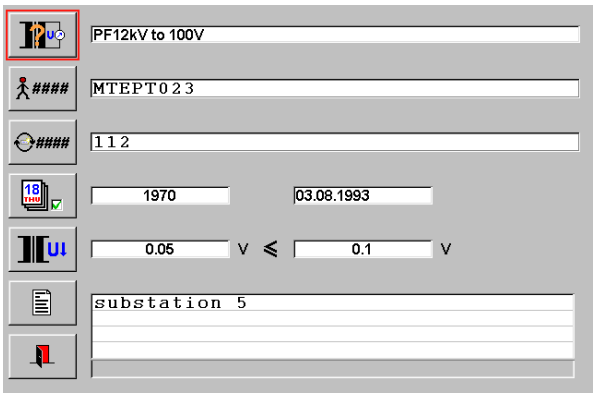
Actual PT type dataset
Enter or modify directly with THB and keypad or external keyboard for:

- Manufacturer
- Potential transformer PT type dataset
- Accuracy class
- Primary voltage
- Secondary voltage
- Nominal burden
- Exit, back to calling menu

6.6.4 Potential transformer PT dataset



Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual PT dataset
Object files for potential transformer PT's and potential transformer PT types can be loaded. The file names of the actual loaded object files are shown at:

- Potential transformer PT type

Enter or modify directly with THB and keypad or external keyboard for:

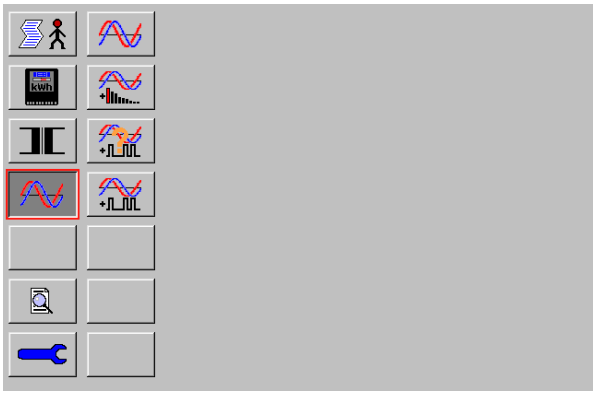
- Owner number
- Serial number
- Production year / certification date
- Voltage drop fuse / voltage drop total
- Comment to CT dataset
- Exit, back to calling menu

Indications / settings

	Load / edit object file

The file selection menu [6.1] is called with the object file directory:
PT Type Selections
For description of actual potential PT type dataset see [6.6.3]

6.7 Load point data



Load point data menu
Object files for load point data can be loaded. The file names of the actual loaded object files are shown at:

- Load point dataset
- Harmonics
- RCS Ripple Control telegram type dataset
- RCS Ripple Control Sequence dataset

6.7.1 Load point dataset

Indications / settings

	Load / edit object file

The file selection menu [6.1] is called with the object file directory:
Load point Selections
For description of Load point dataset see [7.1.2]

6.7.2 Harmonics dataset

	Load / edit object file

The file selection menu [6.1] is called with the object file directory:
Harmonics Selections
For description of Harmonics dataset see [7.2.1]

6.7.3 Ripple control RCS telegram type dataset

	Load / edit object file

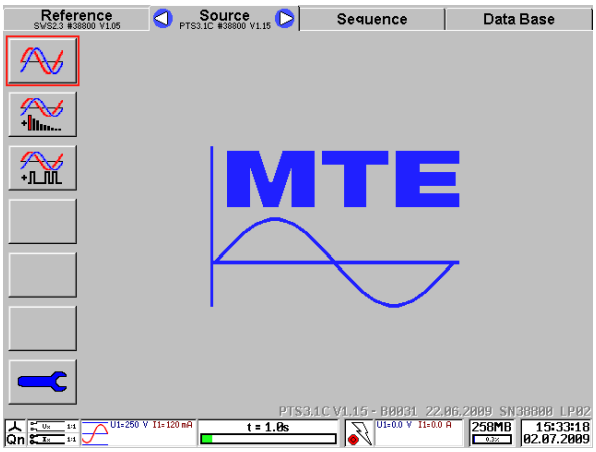
The file selection menu [6.1] is called with the object file directory:
RSC Param Selections
For description of RCS Ripple Control parameter type dataset see [7.3.2]

6.7.4 Ripple control RC Sequence dataset

	Load / edit object file

The file selection menu [6.1] is called with the object file directory:
RCS Telegram Selections
For description of RC Sequence Telegrams dataset see [7.3.1]

7. Source Operation of the Source



Source menu card

This menu card contains the following menus and functions:

Source

- Name of menu card
- Type and serial number of PTS 3.1 C
- Firmware version

- Load Points menu
- Harmonics menu
- Ripple Control menu
- Power Source Setup menu
- Status line

Warning!
There might be dangerous voltages and currents at the terminals of the power source after switching it ON. Regard the local safety precautions before working with the device.

	Call **Load Point** menu [7.1]

The menu allows the handling and definition of the load points with the setting of all possible parameters.

	Call **Harmonics** menu [7.2]

The menu allows the handling and definition of harmonics with the setting of all possible parameters.

	Call **Ripple Control** menu [7.3]

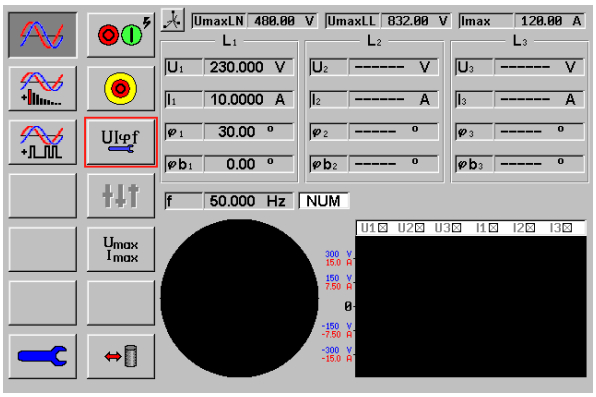
The menu allows the handling and definition of ripple control telegrams with the setting of all possible parameters.

	Call **Power Source Setup** menu [7.5]

The parameters menu is reserved to MTE service staff. The display of the parameters will be useful for the user to give detailed information to the service staff.

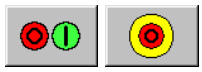
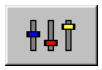
Warning!
The power source will also work without compact flash card. The database is saved on the compact flash card and therefore will be no access to the database without compact flash card. The initial settings UIφf will be 0. At least UIφf must be set and the settings Umax Imax must be checked before operation.

7.1 Load point definition



Load point menu
This menu contains the following menus and functions additional to the power source menu:

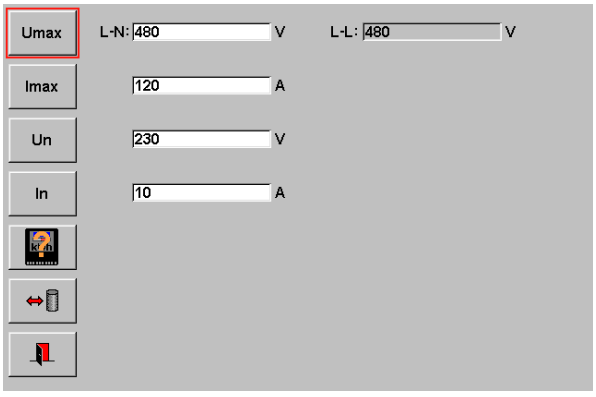
- Start/Stop load point
- Fast Stop load point
- UIφf menu
- UmaxImax menu
- Display of network selection
- Load/save menu
- Display of UmaxImax settings
- Display of UIφf settings
- Vector diagram monitor
- Waveform monitor

	**Start/Stop** power source and **Fast Stop** power source [7.4]
	Call **Edit Load point UIφf** menu [7.1.2]
	Call **Slider Screen** [7.4.6]

The Slider Screen can be chosen for manual setting of voltage, current and angle with the help of sliders. The function can be selected after the start of a load point.

	Call set/edit **Umax Imax** menu [7.1.1]
	**Load/save** settings from/to directory **Load Point Selections**

7.1.1 Setup of Umax and Imax and nominal values Un and In



Umax Imax menu
This menu contains the following menus and functions:

- Edit UmaxLN
- Edit UmaxLL (not available at PTS3.1C)
- Edit Imax
- Edit Un
- Edit In
- Call meter types menu
- Load/save Umax Imax settings menu

Umax	**Maximum voltage Umax**

The amplitude of the output voltage will be limited to the setting UmaxLN. It can prevent damages of reference meter and meter under test.



The phase to neutral maximum voltage UmaxLN can be set in the range 0V...480V.

Imax	**Maximum current Imax**

The amplitude of the output current will be limited to the setting Imax. It can prevent damages of reference meter and meter under test.



The maximum phase current Imax can be set in the range 0A...120A.

Un	**Nominal voltage Un**



Nominal phase -neutral voltage (LN) can be set here in the range:

Un (LN): 0 V … UmaxLN

In	**Nominal current In**



The nominal current In can be set in the range 0A...120A. Therefore the basis current Ib or nominal current In of the defined meter will be taken. The nominal current will be limited to <Imax>.

Load Meter Type settings from directory **Meter Type Selections** [6.5.1]

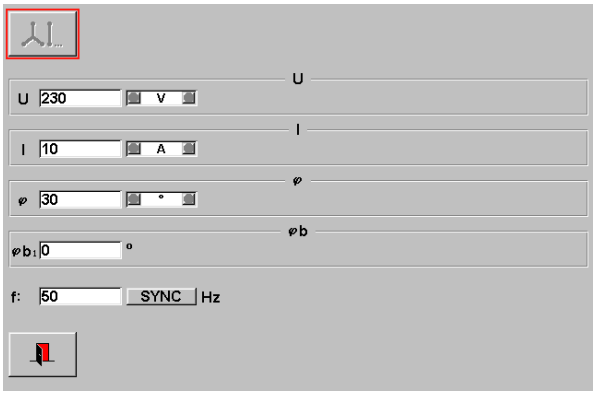
The parameter Un, In, Imax will be loaded from selected meter type.

Load/save settings from/to directory **Source Limits** [4.4]

The settings UmaxLN, Imax, Un and In can be loaded or saved.

Exit and accept settings, back to calling menu.

7.1.2 Edit load point



Edit load point menu
This menu contains the following submenus and functions:

- Edit voltage U
- Edit current I
- Edit phase angle current to voltage φ
- Edit start phase angle in relation to synchronization signal SYNC
- Edit frequency and frequency mode (SYNC: Frequency synchronous to supply voltage)

Network selection (not available at PTS3.1C)

U 230 V Edit phase to neutral voltage U

V — The value for the phase to neutral voltage can be set between 0V...480V. The voltage will be limited to <UmaxLN>.

%Un — The value for the phase to neutral voltage can be set in % of voltage Un. The phase to neutral voltage will be limited to <UmaxLN>.

I 10 A Edit phase current I

A — The value for the current can be set between 0A ... 12A or 0A ... 120A. The current will be limited to <Imax>.

%In — The value for the current can be set in % of current In.

%Imax — The value for the current can be set between 0%...100% Imax.

φ 30 ° Edit phase angle between I and U

The value of the angle between current and voltage can be set in degree, cosLA, cosLE, sinLA or sinLE. The unit can be selected with the up/down cursor keys. The values can be set with the help of the keypad or the THB.

Unit	Input range	Input steps with THB	Calculation of angle φ
°	-360°...+360°	1°	
cosLA	-1...+1	-1, -0.866, -0.5, .0.25, 0, +0.25, +0.5, +0.866, +1	φ = acos (x)
cosLE	-1...+1	-1, -0.866, -0.5, .0.25, 0, +0.25, +0.5, +0.866, +1	φ = - acos (x)
sinLA	-1...+1	-1, -0.866, -0.5, .0.25, 0, +0.25, +0.5, +0.866, +1	φ = asin (x)
sinLE	-1...+1	-1, -0.866, -0.5, .0.25, 0, +0.25, +0.5, +0.866, +1	φ = 180° - asin (x)

φb1 0 ° Edit start phase angle of voltage

The start phase angle φb1 of the voltage in relation to the synchronization signal (supply voltage) can be set in the range 0°...+360°.

	**Edit frequency**



NUM (numerical mode)

The frequency of the fundamental wave can be set independently of the line frequency in the range 45Hz...400Hz.
NUM is indicated behind the frequency value in the source main menu.

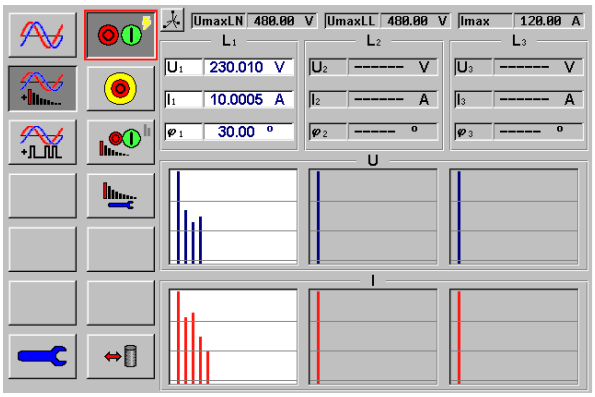


SYNC (synchronization mode)

The frequency is synchronized to the supply line frequency.

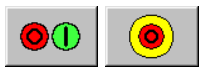
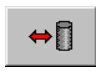
	**Exit** and accept settings, back to calling menu.

7.2 Harmonics

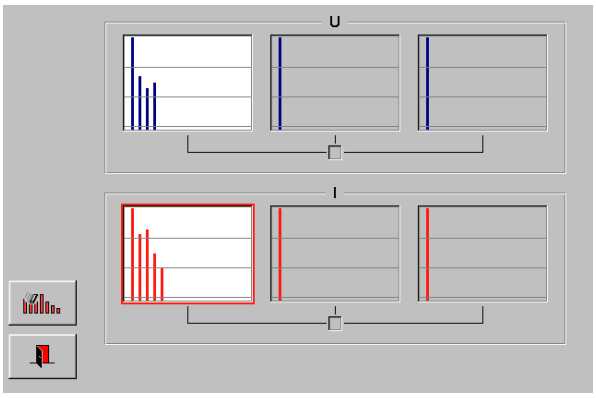


Harmonics menu
This menu contains the following menus and functions additional to the power source menu:

- Display of voltage harmonics settings L1
- Display of current harmonics settings L1
- Edit Harmonics menu
- Load/save harmonic settings menu

	**Start/Stop** power source and **Fast Stop** power source
	**Start/Stop harmonics**
	Call **Edit Harmonics** menu
	Load/save settings from/to directory **Harmonics Selections**

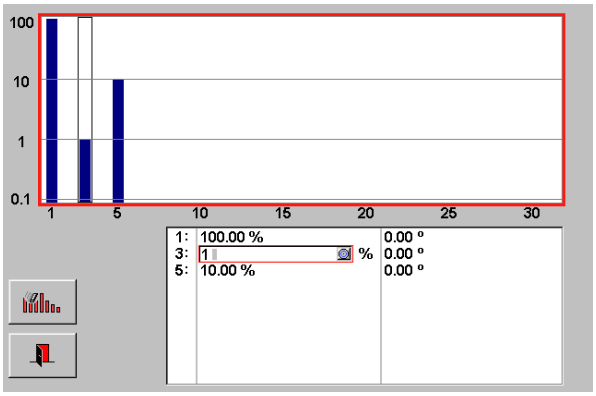
7.2.1 Setup of Harmonics



Edit harmonics menu
This menu contains the following functions:

- Edit function for setting of voltage harmonics
- Edit function for setting of current harmonics
- Reset all harmonics

Edit harmonics



Edit harmonics

- Up to 15 harmonics can be defined
- The sum of all harmonics is limited to 40%, from 2nd...6th the maximum amplitude is 40% and from 7th...31st 10%
- The maximum amplitude is limited for each harmonic separately
- The phase angle of each harmonic can be varied
- Selection of 2nd...31st harmonic
- Reset all harmonics function
- Exit



Range 1%...40%, these values can be set in steps of 1% with THB or individual with keypad.



Angle range -360°...+360°, values can be set in steps of 10° with THB or individual with keypad..



Exit and accept settings, back to calling menu.

Reset Harmonics

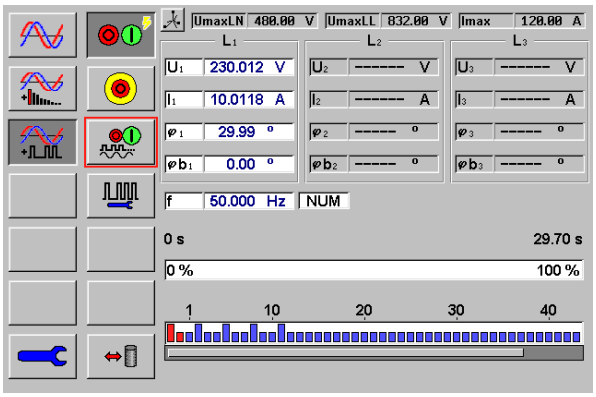
All harmonics will be set to 0%.



Before erasing the harmonic settings the security question will appear. Choosing OK will erase the current settings.

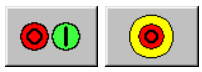
Exit and accept settings, back to calling menu.

7.3 RCS Ripple Control Signals



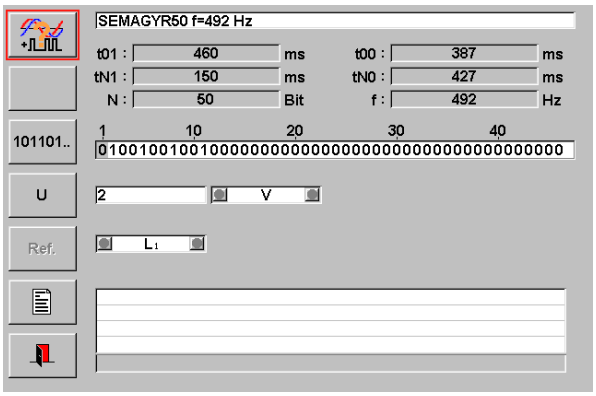
Ripple Control menu
This menu contains the following menus and functions additional to the power source menu:

- Display of ripple control status
- Display of ripple control telegram
- Ripple control setup menu
- Start/Stop ripple control
- Load/save ripple control settings menu

	**Start/Stop** and **Fast Stop** [7.4]
	**Start/Stop** RCS signal [7.4.8]
	Edit **RCS telegram** [7.3.1]
	**Load/save** settings from/to directory **RCS Telegram Selections**

The RCS telegram settings will be loaded or saved.

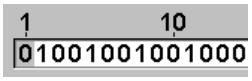
7.3.1 Setup of RCS telegram



Ripple Control telegram menu
This menu contains the following menus and functions additional to the power source menu:

- Select/edit Ripple control telegram type
- Edit Ripple control telegram
- Edit Signal amplitude
- Edit Comments
- Exit

	Select/edit telegram type settings from/to directory **RCS Param Selections** [7.3.2]
101101..	**Edit Telegram**



Input of the steering impulses (address bits and impulse bits). The input field contains N impulse places.(e.g. N=50 for Semagyr, N=10 for Decabit)

U	**Edit Ripple control signal amplitude**



Input of the signal amplitude either in %U or in V.

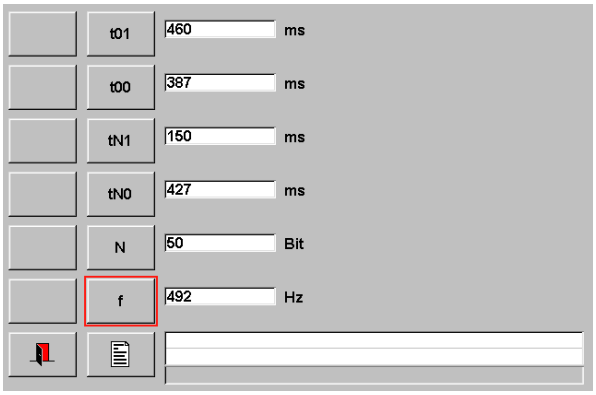
	Edit Comment



Input of a text with up to 128 characters.

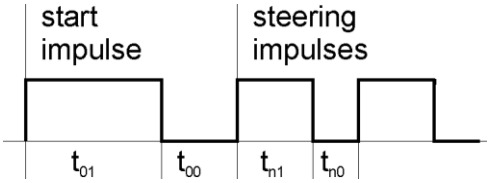
	Exit and accept settings, back to calling menu.

7.3.2 Setup of RCS telegram type



Edit RCS telegram type menu
This menu contains the following functions:

- Edit telegram structure with the parameter t00, t01, tN0, tN1
- Edit ripple control steering impulse places N.
- Edit of ripple control frequency f.
- Edit comments



t_{01}	Time of start impulse
t_{00}	Pause time between start and first steering impulse n1
t_{n1}	Time of steering impulse
t_{n0}	Pause time between steering impulses

t01	**Edit start impulse**

460 ms — Input of the start impulse time in ms.

t00	**Edit start impulse pause**

387 ms — Input of start impulse pause time in ms.

tN1	**Edit steering impulse**

150 ms — Input of the steering impulse time in ms.

tN0	**Edit steering impulse pause**

427 ms — Input of steering impulse pause time in ms.

N	**Edit number of steering impulses**

50 Bit — Input of the number of steering impulses according the defined telegram type in the range of 0...256.

f	**Edit ripple control frequency**

492 Hz — Input of the ripple control frequency in Hz.

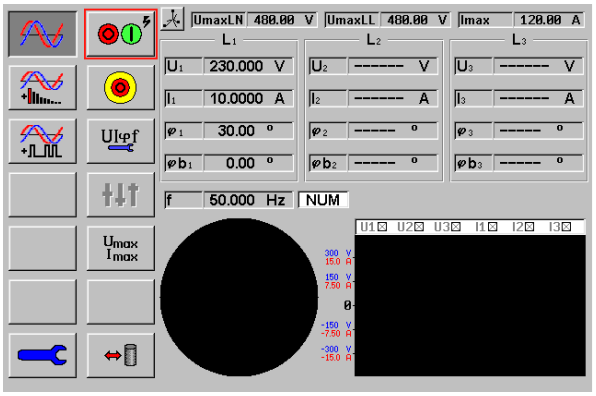
	Edit comments

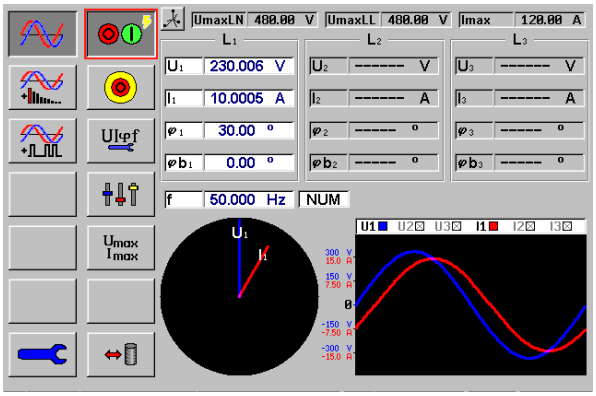
COMMENTS

Input of text with up to 64 characters.

	Exit and accept settings, back to calling menu.

7.4 Execute load point





Warning!
Check all connections in the test circuit.
Check the settings UmaxImax.
Check the settings UIφf.

	Fast Stop

The output signals of the power source will be stopped immediately by pushing the FB **Fast Stop**.

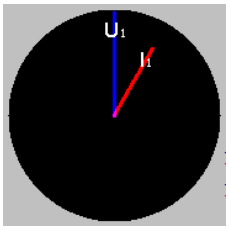
7.4.1 Functional button (FB) Start/Stop power source

Status of FB	Status of power source	Description
		The FB Start/Stop is light gray and marked with a black blizzard. The power source is switched off. The power source can be started pushing the FB Start/Stop. The output signals will be raised in a ramp to the set value.
		The FB Start/Stop is dark gray and marked with a red and yellow blinking blizzard. The settings UIφf or Umax Imax have been changed. The power source is running and will change the output signals in a ramp to the set value after pushing the FB Start/Stop.
		The power source is switched on. The key is dark gray and marked with a yellow blizzard. The power source can be stopped pushing the FB Start/Stop. The output signals will be decreased in a ramp.

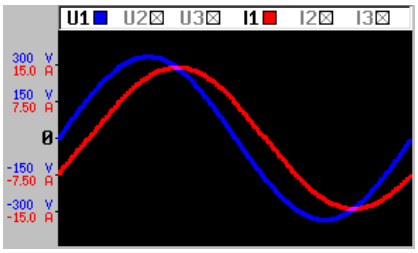
7.4.2 Indication Status of power source

Indication	Status of power source	Description
	OFF	The symbol with red button and white blizzard is shown. The power source is switched off.
	ramp up/down	The symbol with gray sandglass and yellow blinking blizzard is shown. The power source is on. The power source ramp up or down voltage and current or the power source is switching off (Fast Stop).
	ON	The symbol with green button with yellow blizzard is shown. The power source is on. Output voltage and current are stable.

7.4.3 Vector diagram and waveforms



The vector diagram shows the actual voltage vectors and current vectors.

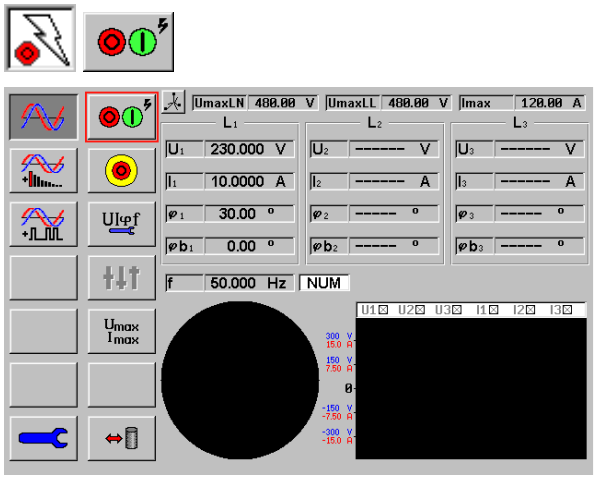


The waveform monitor shows the actual voltage wave form and current waveform. The scale will automatically be set according the amplitude of the signals. One period of the signal will be displayed.

7.4.4 Switch ON/OFF sequence

1	Check measuring setup and settings

Warning!
Check all connections in the test circuit.
Check the settings UmaxImax.
Check the settings UIφf.

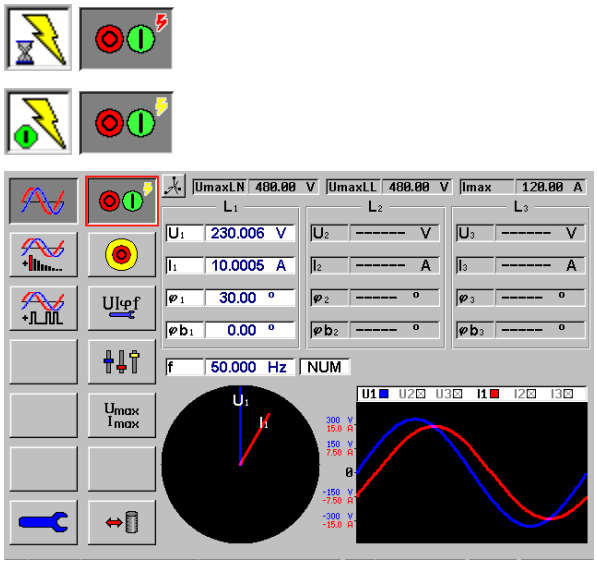


Status indication when the power source is switched OFF

The power source is switched off

- The settings are all grayed out.
- Vector diagram monitor is dark
- Wave form monitor is dark
- Power source indication is OFF

2	Switch ON power source



Status indication during ramping up voltage and current to the set value.

Status indication when the power source is switched ON

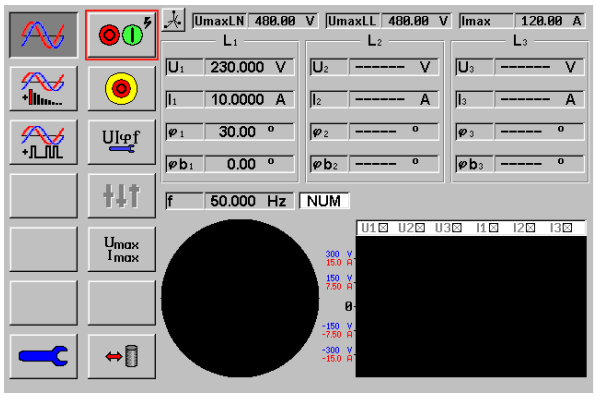
The power source is switched on.

- Voltage and current are stable.
- The measured values will be displayed instead of settings.
- Vector diagram monitor is ON.
- Waveform monitor is ON.
- Power source indication is ON.

3	Run test

4a Switch off the power source





Status indication when ramping down voltage and current.

The power source is switched off

- The settings are all grayed out.
- Vector diagram monitor is dark
- Wave form monitor is dark
- Power source indication is OFF



Status indication when the power source is switched OFF

4b Fast switch off the power source

The power source will be stopped immediately without ramping down the output signals. The status indications will be identically as described in the switch off procedure with FB Start/Stop in step 4a.

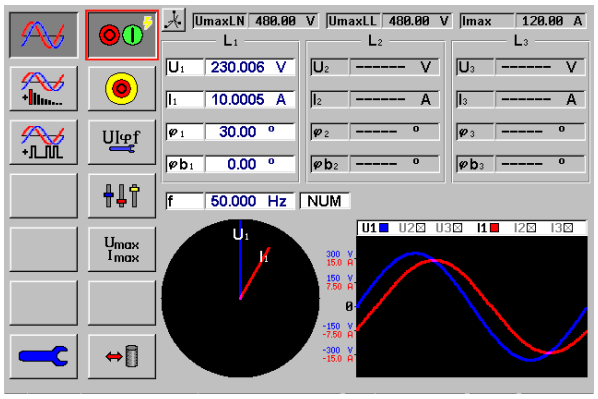
7.4.5 Change settings of load point

1	Check measuring setup and settings

Warning!
Check all connections in the test circuit.
Check the settings UmaxImax.
Check the settings UIφf.

2	Switch ON power source





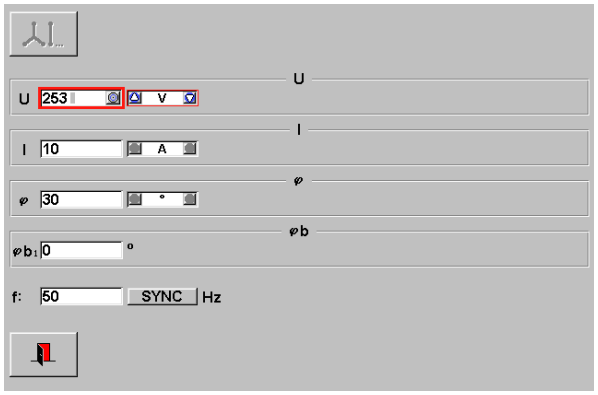
Status indication during ramping up voltage and current to the set value.

Status indication when the power source is switched ON

The measured values of voltage, current, phase angle, start phase angle and frequency are shown.

3	Call the UIφf menu

4	Change settings

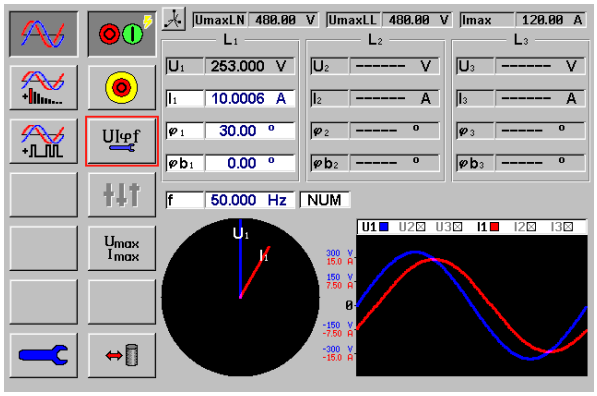


One or several values can be changed. In this example U has been changed from 230V to 253V.

5		**Exit** and accept settings, back to calling menu.



Power source is still switched ON. The blizzard is flashing red/yellow



The changed settings are grayed out.

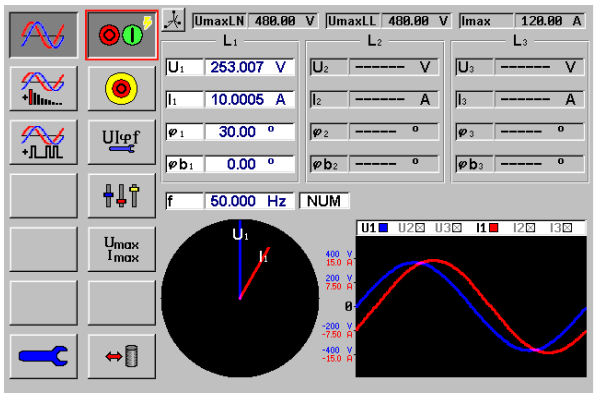
6		Switch on new settings



Status indication during ramping up or down voltage and current to the new set value.



The power source is running with the new settings.



The actual measured load point values are displayed.

7.4.6 Load point adjustment with regulators

1		Select load point menu

The load menu is switched ON

2		Check measuring setup and settings

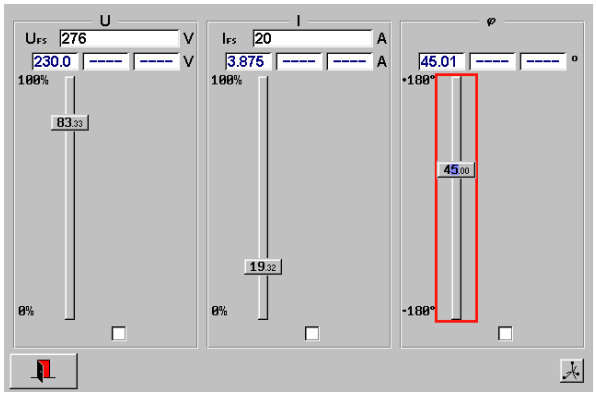
Warning!
Check all connections in the test circuit.
Check the settings UmaxImax.
Check the settings UIφf.

3		Switch on the power source first

Status indication during ramping up voltage and current to the set value.

Status indication when the power source is switched ON

4		Select the slider menu





- In the case U_{FS} or I_{FS} is smaller than the actual voltage U or current I, the output of the source will be limited to U_{FS} and I_{FS}.
- Changes will affect to the output immediately.

The actual measured values will be displayed.

5		Set full scale voltage U_{FS}



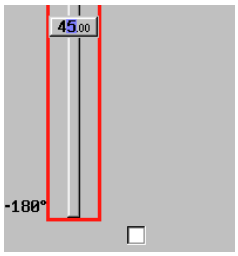
The full scale voltage can be set in the range 0V...Umax.

6		Set full scale current I_{FS}



The full scale current can be set in the range 0...Imax.

7 Set voltage U, current I and phase angle φ

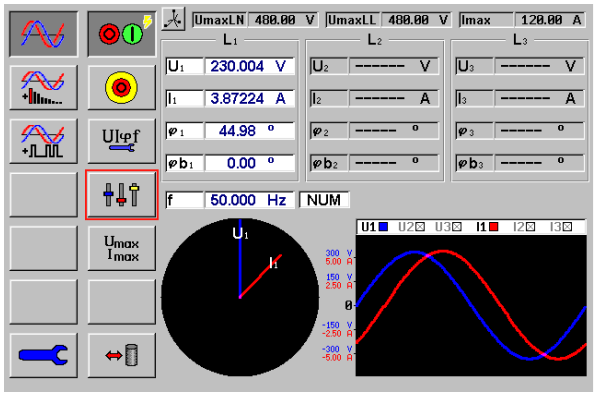


The slide for phase angle show the settings absolute in degrees.



Additional to changes with the THB a single digit (blue marked) can be selected with the left/right cursor keys and can be individually changed with the up/down cursor keys. This allows changes in defined steps (10 / 1 / 0.1 / 0.01).

8 Exit and save settings



The settings are already active and the measured values are displayed.

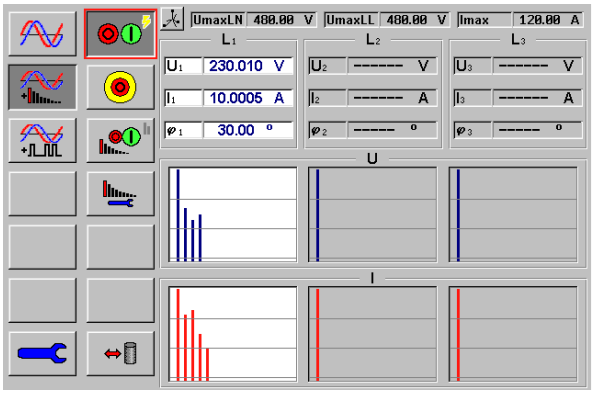
7.4.7 Switch Harmonics ON / OFF

1		Switch on power source first

Status indication during ramping up voltage and current to the set value.

Status indication when the power source is switched ON

2		Select harmonics menu



- Harmonics menu on
- Display the harmonic monitor

3		Define or select the harmonics

4		Switch on the selected harmonics

Indication harmonics on

5	**Run test**

6		Switch off harmonics

Indication harmonics switched off

7.4.8 Switch RCS telegram ON / OFF

1		Switch on the power source first

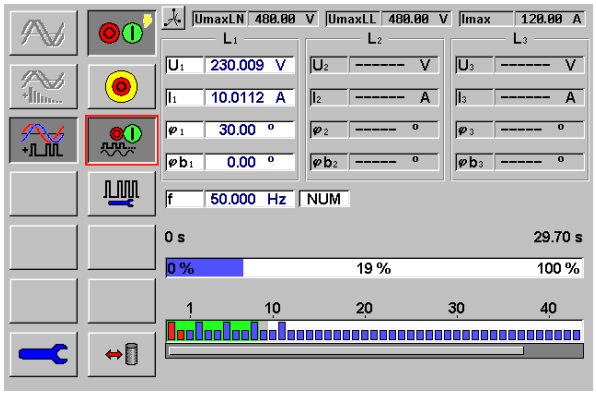


Status indication during ramping up voltage and current to the set value.



Status indication when the power source is switched ON

2		Select the ripple control menu



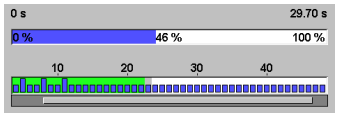
- Ripple control menu on
- Display with ripple control monitor

3		Define or select the ripple control signal

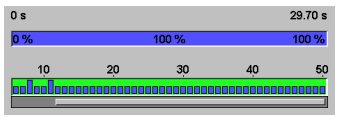
4		Switch on the selected ripple control signal



Indication that the ripple control telegram is switched on and is in execution.



The ripple control telegram is in execution.



The total run time for the selected telegram can vary from several seconds up to several minutes.

5		Switch off ripple control signal (if necessary during execution)



Indication ripple control signal switched off

6		Switch off the power source



Indication power source switched off

7.5 Setup



Power source setup menu
This menu contains the following menus and functions:

- Current output selection
- Power source system parameters menu
- Load/save source selections menu

	Select **Current output**

Selection of current outputs for currents 0 A … ≤10 A (toggle mode):

1A/10A current outputs used
The current connections must be changed for currents > 10 A.

120A outputs used
The same current connections can be used for the full range 0 A … 120 A.

For the currents >10 A … 120A always the high current outputs are used.

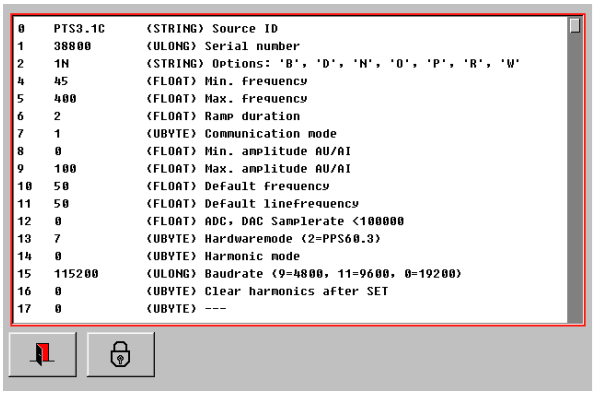
Note: Independent of the current output selection, the current input selection at the reference standard (Reference / setup menu) must always be:
Direct current inputs 1A/10A for the range **0 A ... ≤10 A** and
Direct current inputs 100A for the range **>10 A … 120 A**.
This selection is made automatically in the basic control mode **Test System**, but must be made manually in the mode **Reference + Source**.

	Call **Power source system parameters** menu

	Load/save settings from/to directory **Source Selections**

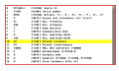
	Exit and accept settings, back to calling menu.

7.5.1 Parameters

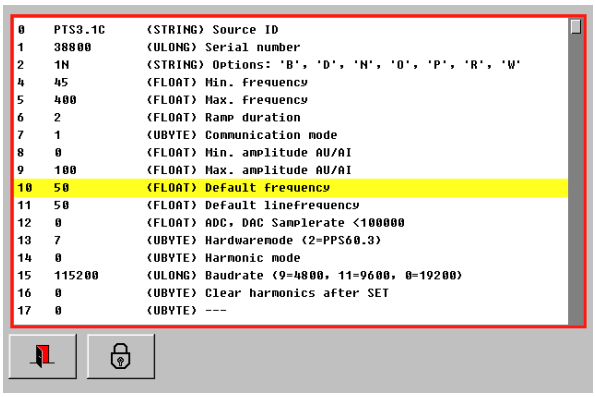


Power source system parameters menu
The parameter menu shows the power source parameters. This menu contains the following functions:

- Display with all power source parameters, select/edit parameters
- Password enter screen
- Exit



Select/Edit parameters



The screen shows 17 rows of power source parameters from the parameter list containing up to 1000 parameters. Scroll pages with THB.



Password

Only for MTE service staff.



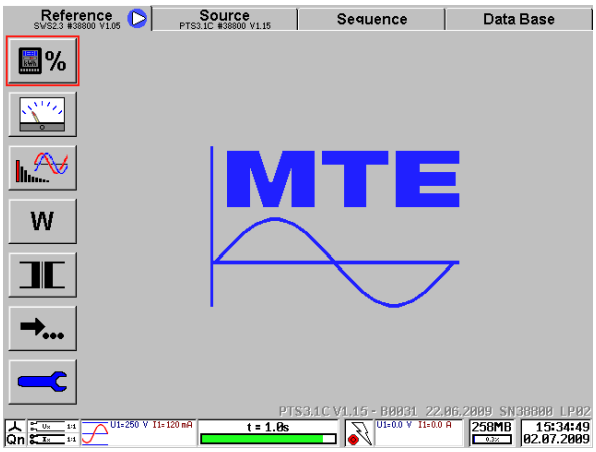


Enter password.



Exit and accept settings, back to calling menu.

8. Reference Standard



Reference menu card
This menu card contains the following menus and functions:



- Name of the menu card
- Type and serial number of integrated reference standard SWS2.3
- Firmware Version


Error measurement [8.2]


Measurement [8.3]


Wave form analysis [8.4]

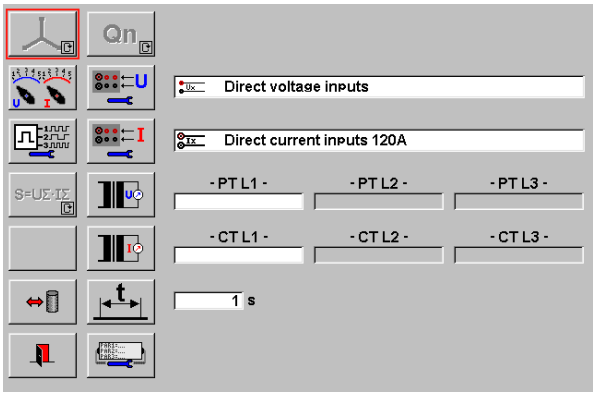

Energy measurement and register test [8.5]


Transformer tests [8.6]


Special functions [8.7]


Setup [8.1]

8.1 Reference meter settings



Reference meter settings menu
The following settings are displayed:


Connection mode (4-wire), fix setting


U / I range settings


Frequency outputs


Apparent power mode (applied calculation formula), fix setting


Load or save current parameters


Exit of menu


Reactive power mode natural (Qn), fix setting


Selection of voltage measurement input


Selection of current measurement input


Voltage transformer


Current transformer


Time base


Reference system parameters

Indications / settings

	**Connection mode 4-wire** (fix setting at PTS3.1C, includes 2-wire mode)


4-wire mode


3-wire mode (not applicable at PTS3.1C)



Call **Range settings** menu [8.1.1]

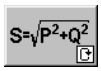


Call **Definition of frequency outputs** menu [8.1.2]



Apparent power mode (fix setting at PTS3.1C, S = U*I)

Selection of the formula used for the calculation of total apparent power ΣS.



Total apparent power calculation is based on total active power and total reactive power values. $\Sigma S = \sqrt{\Sigma P^2 + \Sigma Q^2}$
(not used at PTS3.1C)



Total apparent power calculation is based on the effective values of voltages and currents. $\Sigma S = U\Sigma \cdot I\Sigma$

4-wire: $U\Sigma = \sqrt{U_1^2 + U_2^2 + U_3^2}$; $I\Sigma = \sqrt{I_1^2 + I_2^2 + I_3^2}$

3-wire: $U\Sigma = \sqrt{U_{12}^2 + U_{32}^2}$; $I\Sigma = \sqrt{I_1^2 + I_3^2}$



Call **Load / save reference meter settings** menu [4.4]



Exit, back to calling menu

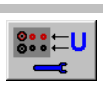


Reactive power mode natural (fix setting at PTS3.1C).

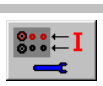




Natural (n) 90° phase shifters in voltage path are used to calculate the reactive power
Artificial or cross-connected (x) The phase to phase voltage between other phases, (which already has a 90° phase shift) is used instead of the phase to neutral voltage. This mode is applicable only to a symmetrical voltage system.



Call **Selection of voltage measurement inputs** menu [8.1.3]



Call **Selection of current measurement inputs** menu [8.1.4]



Call **Voltage measuring transformer PT settings** menu [8.1.5]



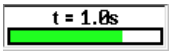
Call **Current measuring transformer CT settings** menu [8.1.6]

Time base

The time base defines the periodic timing interval for the measure and display of all calculated results. These include such values as U,I,P,Q,S, etc. It is also used in conjunction with harmonics analysis and vector diagram displays.
The interval for the update of the results on the display is defined in seconds (s).



Time base manually set
The time base interval can be set manually by the user.
Input of time base interval in seconds (s).
Range: 0.1 … 999.9 s



Status indication of time base
The time base interval in seconds is displayed together with a bar graph, indicating the elapsed time of the active running measurement.





External time base
In the case of entering zero, the time base switches to

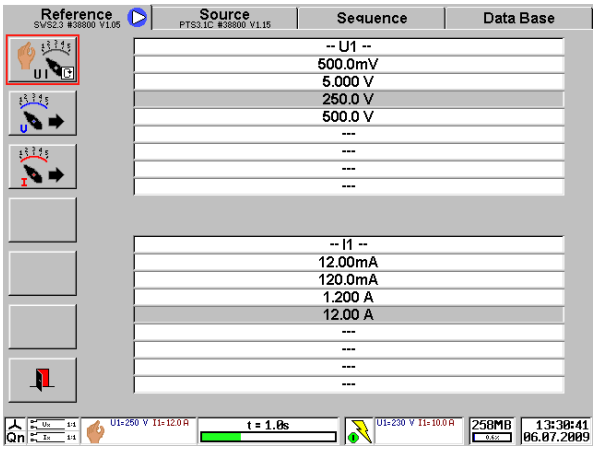
external time base.
By means of this function, an external pulse via pulse input socket 1 can be used to trigger the display of new results. This allows the display of the results to be synchronised with external instruments.



Status indication of external time base
The time base interval defined by the last two external impulses in seconds is displayed together with a bar graph, indicating the elapsed time of the active running measurement in relation to the previous time interval.

Call **Reference system parameters** menu [8.1.7]

8.1.1 Selection of voltage and current ranges



Voltage and current range settings menu
The following settings of the PTS 3.1 C are displayed:

Auto or manual range selection

manual selection of voltage ranges

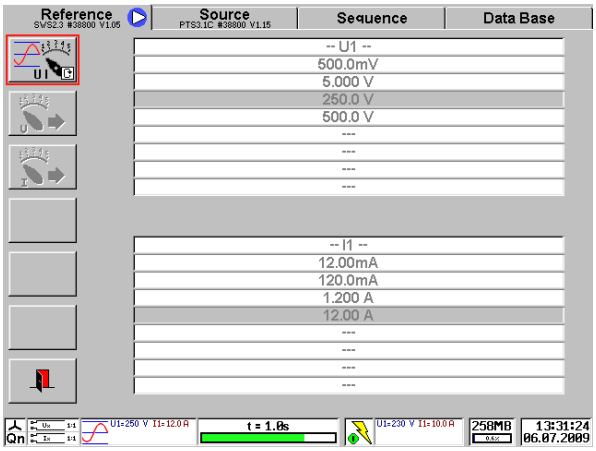
manual selection of current ranges

The wide input dynamic range of voltage and current (several decades) is internally reduced to a smaller dynamic range in order to achieve the required accuracy. This is done by using multiple internal voltage and current sub-ranges.

The range selection can be made either automatically or manually

	Auto or manual range selection

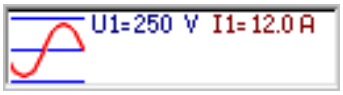
8.1.1.1 Auto range selection



Automatic range selection
(default condition on start-up)
The soft key and the Symbol in the status line indicate that automatic range selection is active.

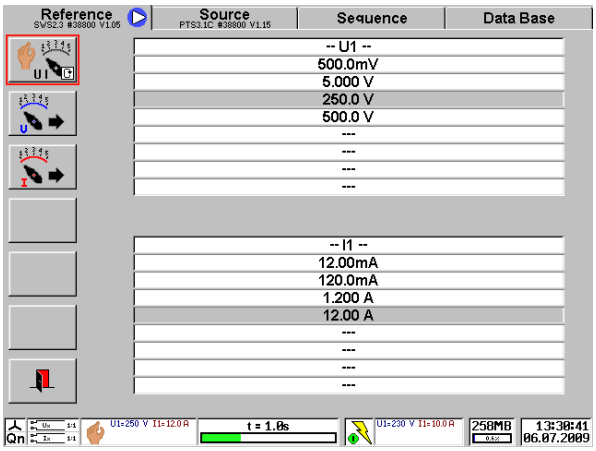
The keys for manual range selection are disabled.

Two tables showing the range maximum values of all internal voltage and current ranges are displayed.
The actual selected ranges are marked



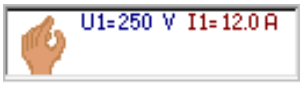
Status indication for automatic range selection
The Symbol indicates that automatic range selection is active.
The actual selected ranges of voltage and current are shown.

8.1.1.2 Manual range selection



Manual range selection
The soft key and the Symbol in the status line indicate that manual range selection is active.

Two tables with the range maximum values for all internal voltage and current ranges are displayed. The actual selected ranges are marked.



Status indication for manual range selection
The Symbol indicates that manual range selection is active.
The actual selected ranges of voltage and current are listed.

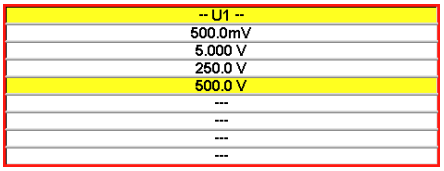


Status indication for manual range overflow
The Symbol indicates that manual range selection is active.
If any of the selected voltage or current ranges, shown in the status line, is too low, the manually selected range is flashing red and a beep is hearable.
The internal voltage and current ranges are changing at 110% of the step, to the higher or lower range

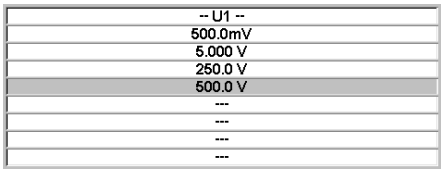
The main application of the manual range selection is to fix a maximum range, to prevent automatic range changes during a measurement. In the case of varying currents or voltages or a current or voltage near the upper limit of an internal range, it is better to fix the next higher range manually, to be sure that no range changes occur during the measurement.
Any range change occurring during an error measurement will invalidate that measurement.




Manual selection of voltage range
The pressed range soft key indicates that voltage range selection is active.



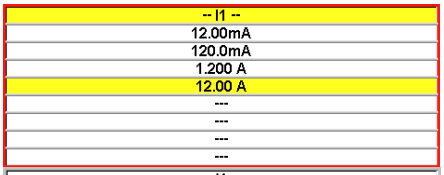
Selection active
A red frame is displayed. -- U1-- and the actual selected range are yellow highlighted.



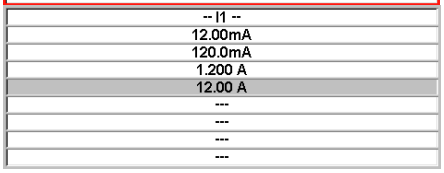
The last highlighted range is selected. The red frame and the yellow highlighting disappear.




Manual selection of current range
The pressed range soft key indicates that current range selection is active.



Selection active
A red frame is displayed. -- I1 -- and the actual selected range are yellow highlighted.

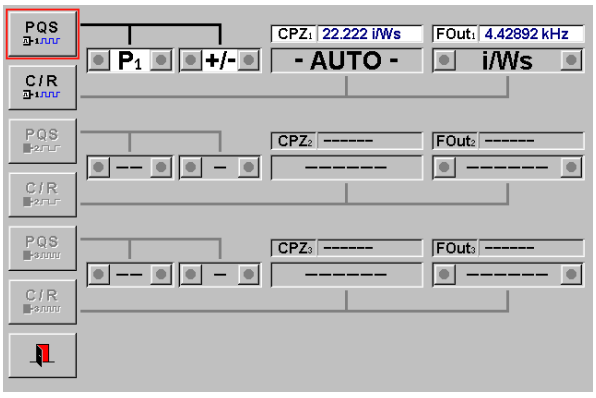


The last highlighted range is selected. The red frame and the yellow highlighting disappear.

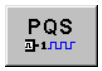


Exit, back to calling menu

8.1.2 Definition of frequency output



Frequency output
The PTS 3.1 C has one individually configurable impulse output. The impulse outputs 2 and 3 are not available at this instrument (FBs are shown greyed out).
Active (P1), reactive (Q1) or apparent power (S1) values can be assigned to the impulse output for positive and negative (+/-) direction or restricted to one direction, positive (+) or negative (-) only.
The mean frequency of the output is proportional to the chosen quantity.
Default setting: Active power (P1)



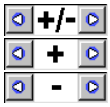
Selection of reference value for the frequency output

Reference value

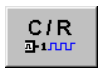


Active power
Reactive power
Apparent power

Direction



Positive and negative (all quadrants)
Positive only (consumption)
Negative only (back feeding)



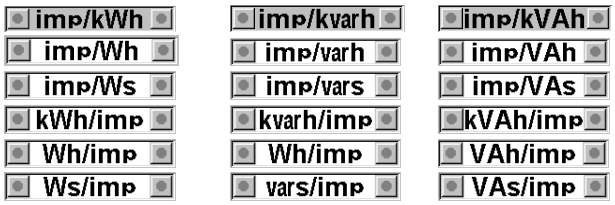
Selection of the meter constant C / R for the frequency output.



Auto
The internal PTS 3.1 C range dependent constant is active.



Constant
Free selectable range independent meter constant
It should be noted that the constant must be selected in such a way that the maximum frequency of 20kHz is not exceeded in the desired operational ranges.



Unit
Selection of the unit of the desired output.



CPZ1
Shows the actual constant at the impulse output.



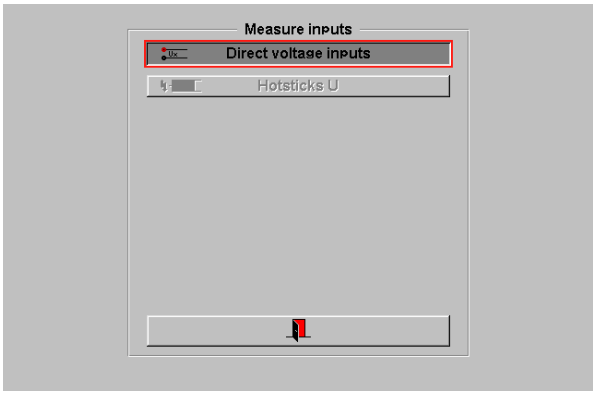
Fout1
Shows the actual frequency output at the impulse.



Exit, back to calling menu

8.1.3 Selection of voltage measurement inputs

This function serves to select the voltage input used, direct connected voltage or hotstick connected for high voltage measuring up to 40kV.





Direct voltage measuring input



Hotstick U up to 40kV (not available)


Back to the main setup screen



Indication on the main setup screen

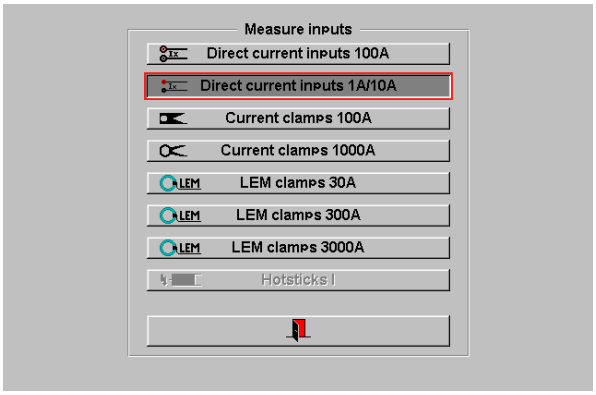
After pressing  the status indication shows the corresponding voltage input.



Status symbol indication for direct voltage measuring input.

8.1.4 Selection of current measurement inputs

This function serves to select the current input used, direct connection, different kinds of current clamps or hotstick connected for measuring up to 2000A.



One of the following inputs for current measurement can be selected.



Direct inputs 120A



Direct inputs 12A



Current clamps 100A



Current clamps 1000A



LEM clamps 30A



LEM clamps 300A



LEM clamps 3000A



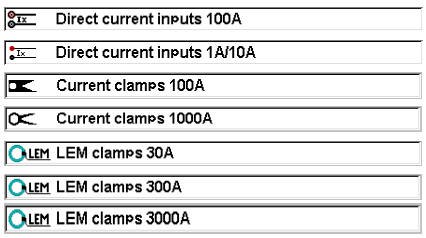
Hotstick I up to 2000A (not available)


Exit

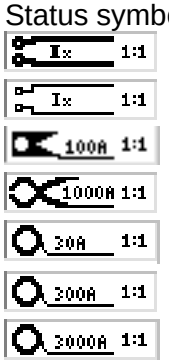
Indication on the main setup screen

Depending on what current input is chosen, after pressing  , on the main setup screen it shows the corresponding current input and the belonging status symbol.

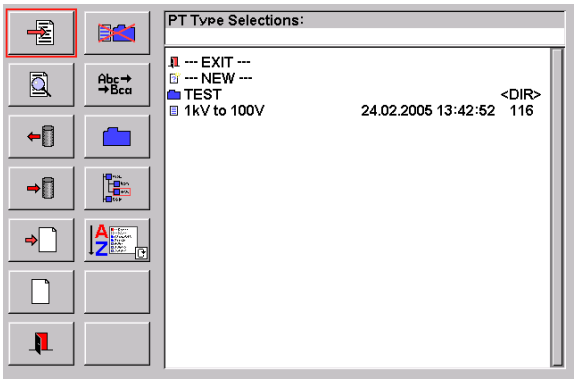
Current input selection indication



Status symbol indication



8.1.5 Voltage measuring transformer PT settings

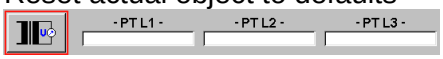


Database functions

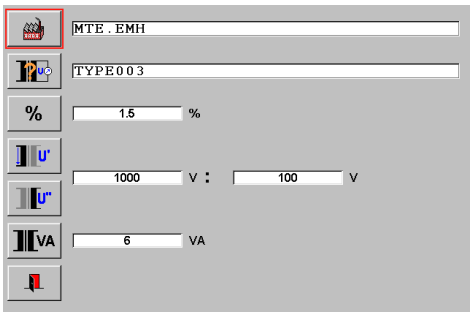
Edit actual object

Load object file from PT Type Selections:

Reset actual object to defaults



Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual PT type dataset menu

Manufacturer

Potential transformer PT type

Accuracy class

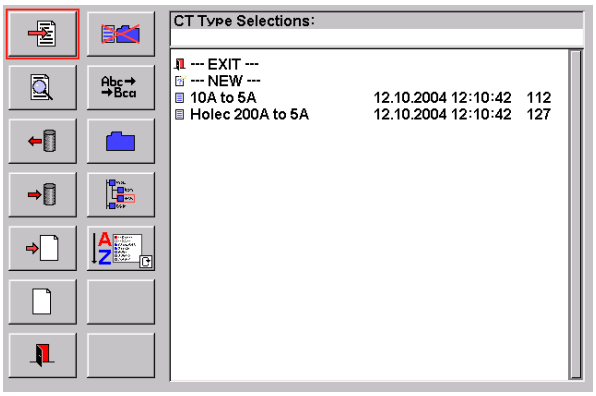
Primary voltage

Secondary voltage

Nominal burden

Exit, back to calling menu

8.1.6 Current measuring transformer CT settings

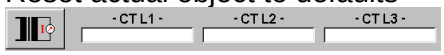


Database functions

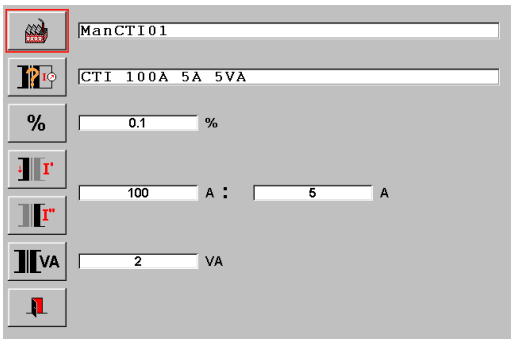
Edit actual object

Load object file from CT Type Selections:

Reset actual object to defaults



Call **edit actual object** or **load object file** or **create new object** at the file selection menu [6.1] to call the actual object menu.



Actual CT type dataset menu

Manufacturer

Current transformer CT type

Accuracy class

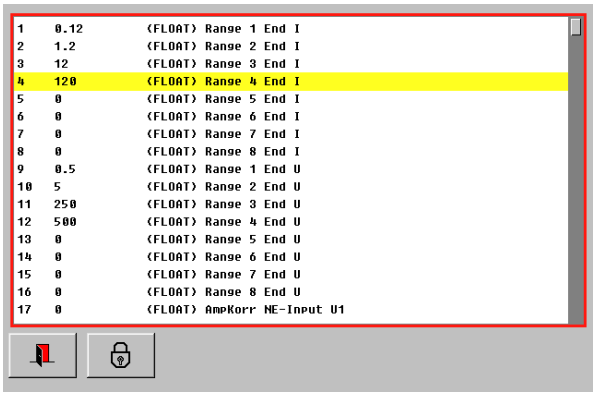
Primary current

Secondary current

Nominal burden

Exit, back to calling menu

8.1.7 Reference system parameters



Parameter settings
This function enables the user to ascertain, in the case of a malfunction, whether the internal parameters of the instrument are set properly. All particular entries as stored in the non-volatile memory are listed here (range end values, correction values, configurations, etc.).

The modification of the parameters is secured by a password and reserved exclusively for the manufacturer and authorized service personal.

These indications can be useful in the case of need to call or for repair work, allowing a clear identification of the instrument.

Password enter

Exit, back to calling menu

Set password

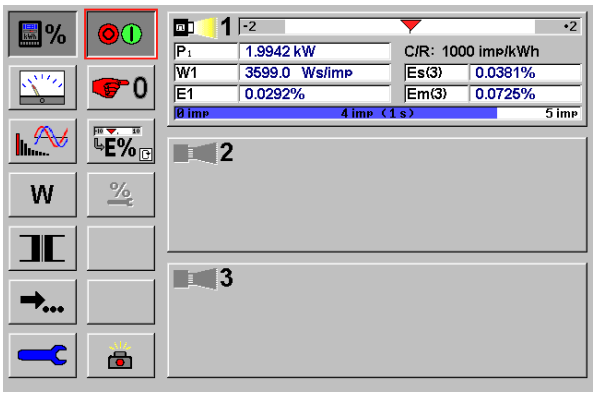


Password
A password is necessary for access to these functions.

Exit, back to calling menu

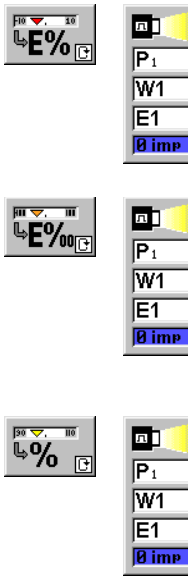
8.2 Error measurement

There is one impulse input, which can be used for error measurements in accordance with the impulse comparison method for active reactive and apparent energy.
The impulse input can be used with scanning head, e.g. the SH 2003, with push button, or with impulse cable which is directly connected to the device under test.



Error measurement menu
The results and basic settings of the error calculation unit 1 for the impulse input 1 are shown. The calculation units 2 and 3 are not active at PTS 3.1 C.
The settings for reference mode, meter constant, measuring period in impulses (imp) or seconds(s) and number of results used for statistical calculations must be defined in the **setup of error measurement** menu [8.2.2].

Error display mode (percentage, per mill, absolute)



Relative error in percentage
The displayed values are related to 0.
No error = 0%.

Relative error in per mill
The displayed values are related to 0.
No error = 0 ‰

1 % = 10 ‰

Absolute error
The displayed values are related to 100.
No error = 100%

The following description is based on the relative error display mode in percentage

Reference power / energy mode

Actual mode P1 is active power / energy. The settings can be changed in the setup menu [8.2.2]

Linked definitions

The actual connection mode (e.g. 4-wire) and actual reactive mode (e.g. natural) can be seen in the status indication at the left lower corner of the display.
These settings are fix at the PTS3.1C. The connection mode single phase 2-wire is included in the 4-wire mode.

C/R: 1000 imp/kWh	**Constant of meter under test**

The value must previously be defined in the setup menu [8.2.2].

P1 1.9942 kW	**Actual power**

The power of the selected reference mode is indicated. The value is updated in the interval of the time base.

W1 3599.0 Ws/imp	**Energy of one impulse (constant of impulse input)**

The measured constant of the impulse input is indicated in the form Ws/imp or Wh/imp. If the test period is n = 1, this is equal to the energy measured between two impulses. For n > 1 the energy of one test period divided by n is indicated.

E1 0.0292%	**Error of energy measurement of input 1**

The result will be updated in the interval defined by n, as soon as n impulses are counted at the input 1. The first measurement will require n+1 impulses, as the first impulse is used to start the measurement process.

Indications during first measurement

E1 . -	Waiting for first impulse to start
E1 --.--	Running the first time

Overflow indications

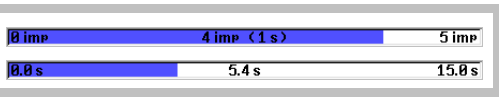
E3 E+	Indication of positive errors > +999.9999%
E2 -100.0000 %	Indication of negative errors > -100%

Es(3) 0.0381% Em(3) 0.0725%	**Mean value Em(x) and standard deviation Es(x) of the error E1**

The calculation is performed over the displayed number of results x in brackets Em(x). After restart of the measurement the value x will be counted up until N, the number of results defined in the setup menu, is reached. Successive calculations are performed over the last N results of E1.
With the setting N = 0 or 1 the value Em(1) = E1 and Es(1) = 0.000 is displayed. The statistic function is disabled and the error value displayed at Em(1) is equal to E1.

	**Graphical error indication with tolerance band**

The arrow indicates the error in graphical form in relation to a selectable tolerance band (e.g. Emin = - 2 %, Emax = + 2 %). The tolerance band can be changed in the setup menu [8.2.2].



Bar graph display of measuring period

A bar graph indicates either the counted impulses with resting estimated measurement time in brackets or the elapsed time in s of the active measurement. At the right side the end value of t/n is displayed within the bar graph, either as impulses or seconds.

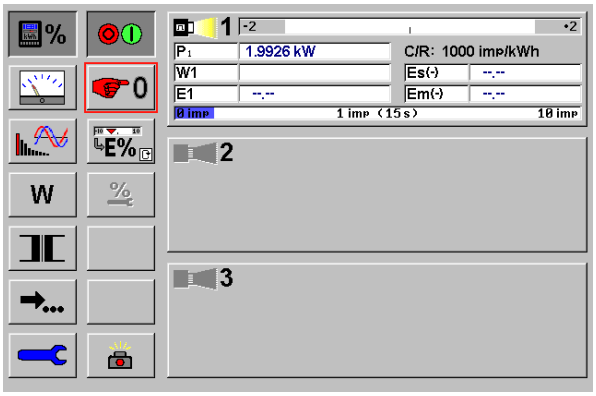
Start / Stop error measurement

The error measurement is activated, if the button is pressed. The 1st impulse will start the error measurement.
The measurement is continuously running until the button is pressed again to stop.

Note: To change settings in the setup menu the error measurement must be stopped before.

Restart of measurement

Each key press causes a restart.



All error results and statistical calculations for mean value and standard deviation are reset.
The evaluation system waits for the first impulse to start a new measurement.
The function is only available, if the start / stop soft key is pressed.

Call **setup of error measurement** menu [8.2.2].

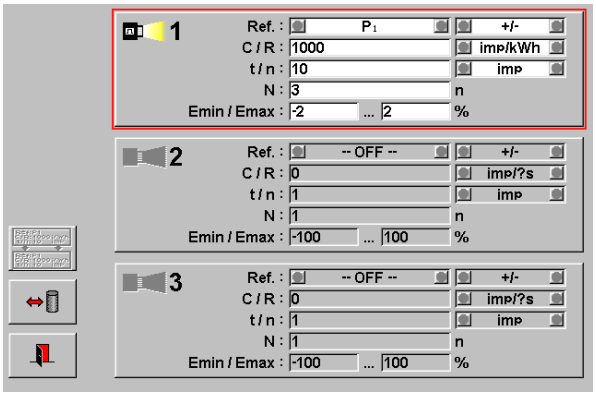
Call **storage and printout of test results** menu [10].

8.2.1 Measuring setup

Examples for measuring setups in different connection modes are described in chapter 11.
Special care must be taken with regards to the grounding of the measuring setup.
We recommend that only one connection of the measuring voltage neutral connector N is made to the protecting earth in the whole measuring setup. Normally this is done at the reference meter. However, if the output of the source used is already grounded, then this should be the only ground in the system. Loops caused by multiple ground connections must be avoided.

8.2.2 % Setup of error measurement

Here the data for the device under test are entered, and the basic settings for the error measurement are defined.



Setup of error measurement menu
In this menu the following basic settings for the error measurement can be made for input 1 (inputs 2 and 3 are not available at PTS 3.1 C):

- Reference energy mode (Ref) and energy direction(+/-)
- Meter constant of device under test (C/R)
- Measuring period (t/n)
- Number of test results used for mean value and standard deviation calculations(N)
- Tolerance band (Emin / Emax)

Ref. : P1 +/-	**Reference mode and energy direction**

This should be the same reference mode as at the device under test.

Reference mode

P1	Active power
Q1	Reactive power
S1	Apparent power
-- OFF --	Input switched OFF, no measurement

Energy direction

+/-	Positive and negative (all quadrants)
+	Positive only (consumption)
-	Negative only (back feeding)

C / R : 1000 imp/kWh	**Constant of meter under test**

Numerical Input of the **constant of the device under test**. An input is also possible in exponential form for large values, e.g. during checking of reference standard meters. The value of the constant is always linked to the unit value, which is defined in the adjacent field(for numerical input see chapter 4.3.1).

Unit Depending on the measurement mode following units can be selected:
In the most cases can be entered in the way familiar to the operator without conversion and just as it is printed on the nameplate of the meter. In this case, 'Imp' stands for impulse. An impulse means the same as a disk rotation or the passing mark on a Ferraris meter, where 'Imp' is often replaced by 'r' for revolution.

	P	**Q**	**S**
Imp/k..h	Imp/kWh	Imp/kvarh	Imp/kVAh
Imp/..h	Imp/Wh	Imp/varh	Imp/VAh
Imp/..s	Imp/Ws	Imp/vars	Imp/VAs
k..h/Imp	KWh/Imp	kvarh/Imp	kVAh/Imp
..h/Imp	Wh/Imp	varh/Imp	VAh/Imp
..s/Imp	Ws/Imp	vars/Imp	VAs/Imp



Measuring period

Definition of the test time by number of impulses **imp** or seconds **sec.**
(for numerical input see chapter 4.3.1).



Number of impulses of device under test. The effective counted number is one more, because an additional start impulse is needed.



Test time in seconds. Based on the actual load and the constant of the meter under test (C/R) the system calculates itself the number of impulses to test. The resultant test time will only be approximate, because the test can only be carried out over an integer number of pulses.



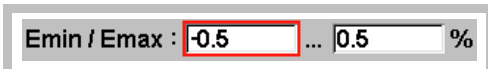
Number of results for statistics

Input of the number of results **N** used for the calculation of mean value **Em(N)** and standard deviation **Es(N)** (for numerical input see chapter 4.3.1).

Em(N):
Es(N):
New measurement: The calculation is made over the last N measurements.

If a new measurement is started, the calculation is made over the already available results, indicated with Es(n), where n = number of results since start of measurement (range: 1 .. N).

N = 1: The statistic function is disabled. The mean value Em(1) is equal to the displayed error Ex, x = 1, 2, 3, and the standard deviation Ex(1) is always zero.



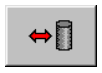
Error tolerance band

Emin / Emax Input of the lower and upper Error tolerance.
The tolerance range of the error bar graph can be changed, in sequential manner: ±100, ±50, ±20, ±10, ±5, ±2, ±1, ±0.5, ±0.2, 0.1, ±0.05, 0, individual for Emin, Emax by turning the THB or any value can be entered by the keypad directly.



Copy parameters from input x (1,2,3) to input y (1,2,3)

Not active, because inputs 2,3 are not available at PTS 3.1 C.



Call **Load / save reference meter settings** [4.4]



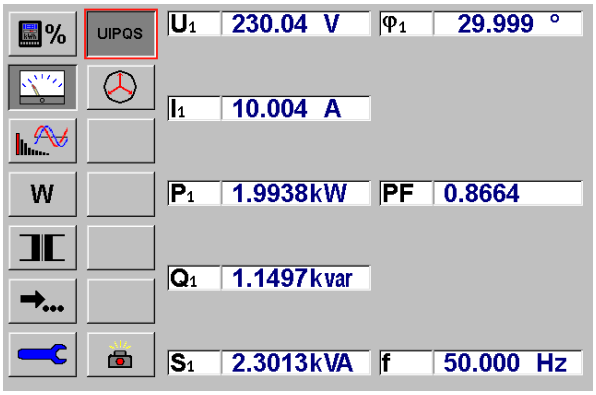
Exit, back to calling menu

8.3 Measurement

With the measurement function, load values and power values as well as vector diagrams can be measured and displayed.

8.3.1 UIPQS values

4-wire mode



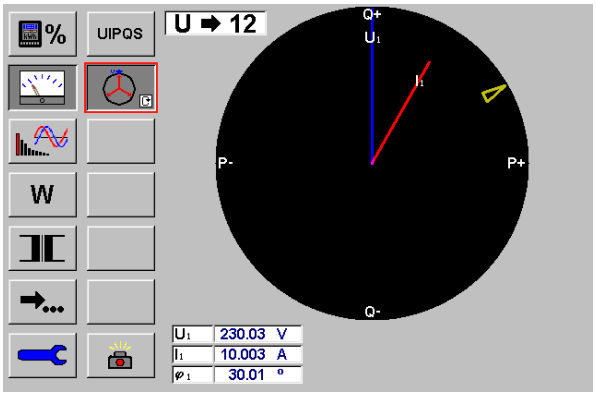
UIPQS values

The display shows all relevant load values of the 2-wire network at the same time.

- Phase to neutral voltage (U_1)
- Phase current (I_1)
- Phase angle current to voltage (φ_1)
- Active power (P_1)
- Reactive power (Q_1)
- Apparent power (S_1)
- Power factor (PF)
- Frequency (f)

8.3.2 Vector diagram

4-wire mode



Vector diagram

The vector diagram of a 2-wire network with a phase shift of 30° between current and voltage is shown.
The reference value for the vector diagram is U, displayed at 12 o'clock. U ➡ 12.
The display is updated at the time base interval.
In the background of the U, I vectors the power quadrants with the axes P+, P-, Q+, Q- are indicated. A green arrow indicates the active power quadrant (e.g. P+Q+).

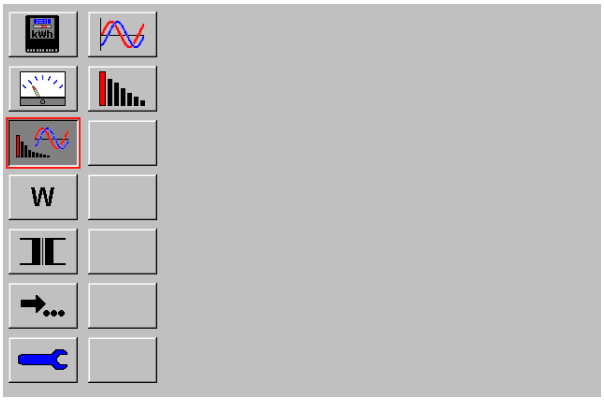


Reference for vector diagram

The reference phase voltage U or current I is defined here. All phase angles are displayed in relation to the reference value, which can have the direction 12 o' clock or 3 o' clock.

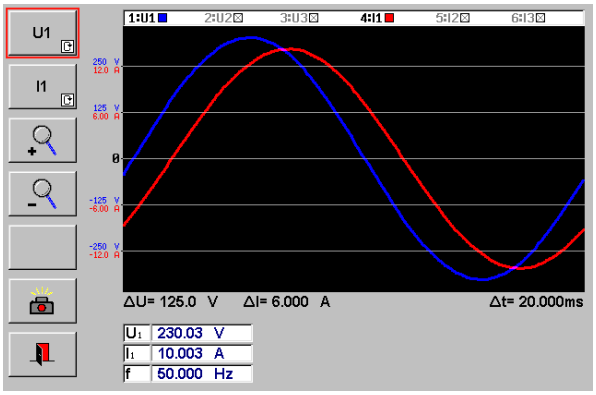
Repeated key pressure changes between (cyclic mode):
U-> 12h / I -> 12h / U -> 3h / I -> 3h

8.4 Wave form analysis

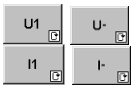


Waveform display menu [8.4.1]
Harmonic analysis menu [8.4.2]

8.4.1 Wave form display

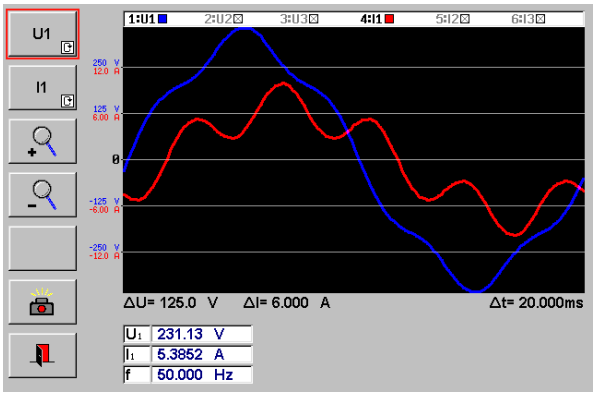


Oscilloscope
The oscilloscope can display one or a combination or all of the signals:



The display shows always one period of the signal, scaled in relation to the actual maximum range values.
At the bottom of the diagram the actual voltage step ΔU and current step ΔI of the vertical axis and the period of the signal Δt are displayed.
The step height depends on the selected ranges and the zoom level.

Phase 3 with 5th harmonic (10% U, 40% I)



Without zoom the step height is half the end of range value.

The vertical axis is divided into three positive and three negative steps, with the actual values for voltage and current indicated beside the horizontal separation lines.

At the bottom the effective values of all signals and the measured frequency are displayed.

The numerical values are updated at the time base interval.

The signals U3, I3 with 5th harmonics displayed here correspond to the results of the analysis in chapter [8.4.2].



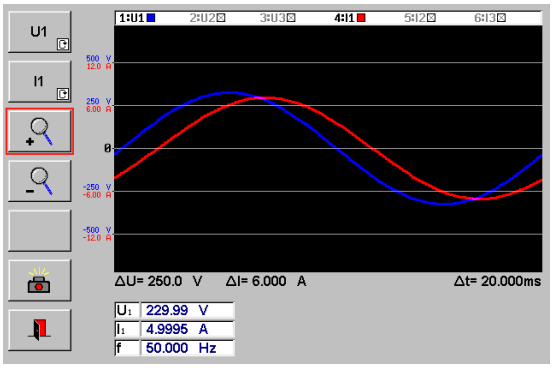
Phase selection

Enable / disable display of voltage U1 or current I1. Toggle between the display (cyclic mode).

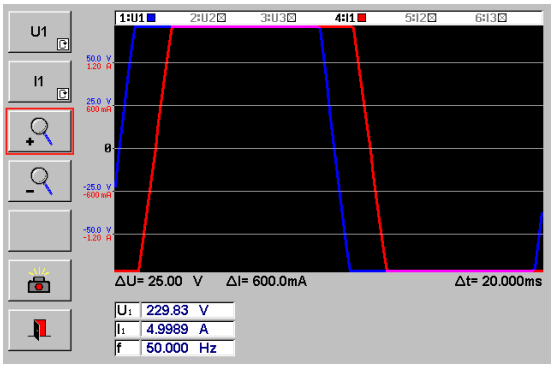
Zoom in /out

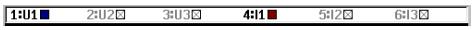
The signal can be zoomed in / out over eight levels:
x 2 / x 4 / x 8 / x 20 / x 40 / x 80 / x 200 / x 400.
The step height beside the vertical axis is changed depending on the zoom level.
With the + /- zoom keys any one of these eight levels can be selected.

Small signal without zoom



Zoom level 3 (x 8)



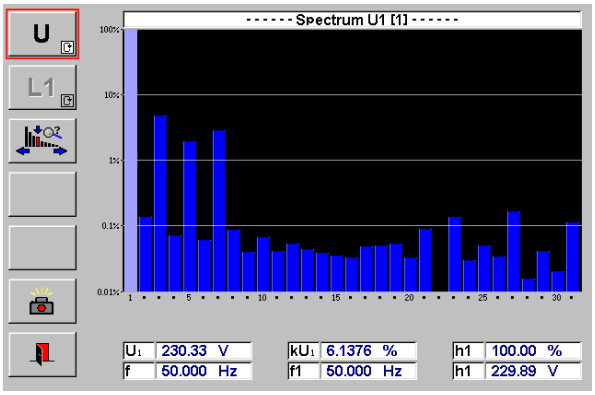


The status of the selection is indicated at the top of the diagram (e.g. U1, I1 activated).

Call **storage and printout of test results** menu [10].

Exit, back to calling menu

8.4.2 Harmonic analysis



Harmonics
Harmonic analysis can be performed for:

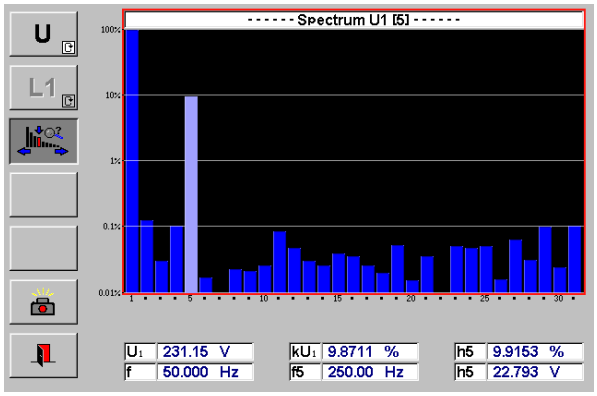
- Phase to neutral voltage (U)
- Phase current (I)
- Active power (P)
- Reactive power (Q)
- Apparent power (S)

Harmonics of order number h1 (fundamental, always displayed as 100%) up to h31 are displayed using a logarithmic scale (0.01 / 0.1 / 1 / 10 / 100%).

Harmonic mode (U, I, P ;Q, S)

Selection of mode for harmonic analysis
Consecutive key presses on the FB will select phase voltage U, phase current I, active power P, reactive power Q or apparent power S.

Analyze individual harmonic

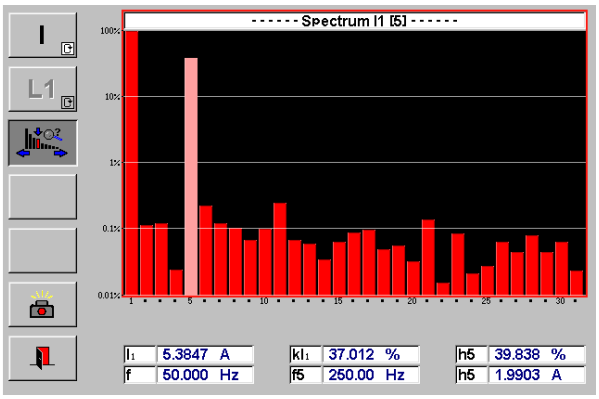


A single harmonic hx (x = 1 … 31) can be selected with the THB. The percentage value h5 9.9153 % of the harmonic in relation to the fundamental waveform and the absolute value h5 22.793 V with the corresponding units (V, A, W, var, VA) as well as the selected harmonic frequency f5 250.00 Hz are displayed at the bottom.
The selected harmonic is highlighted in the graphical diagram.

U1 231.15 V
f 50.000 Hz
kU1 9.8711 %

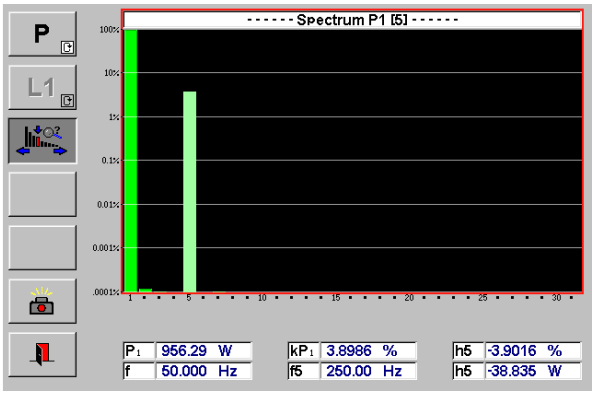
At the bottom are also displayed the effective value (U1) the fundamental frequency (f) and the total harmonic distortion (kU1) of the analyzed signal, updated at the time base interval.

E.g. Harmonics of current



The signal consists of a fundamental of 5A and a 5th harmonic with 40% of the fundamental (2 A).
The effective value (I1) is the square root of the sum of all harmonics squared. Because the 5th harmonic is much bigger than the rest, the other harmonics can be neglected.
The effective value is approximately:
$I3 = \sqrt{(h1^2 + h5^2)} = \sqrt{(5^2 + 2^2)}$
I3 = 5.385 A

E.g. Harmonics of active power

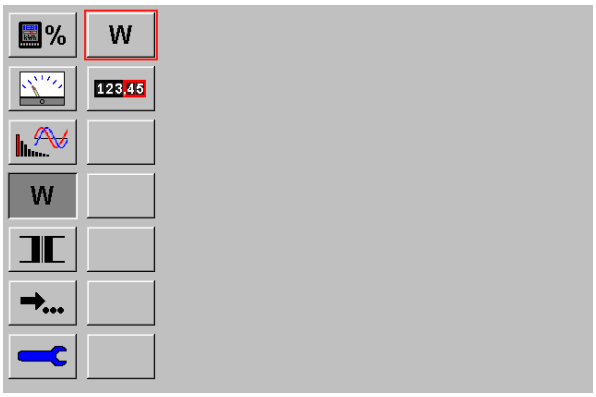


The active power value is based on a voltage signal 230V with 10% of 5th harmonic and a current signal 5A with 40% of 5th harmonic.
These are typical signals used for type tests.
The phase shift from current to voltage of the fundamental wave forms is approximately +30°.
The resulting 5th harmonic of power is -3.9 %. The absolute value of h5 is negative, because the phase shift between the 5th harmonic of current and voltage is approximately 150°.

	Call **storage and printout of test results** menu [10].

	**Exit, back to calling menu**

8.5 W Energy measurement and register test

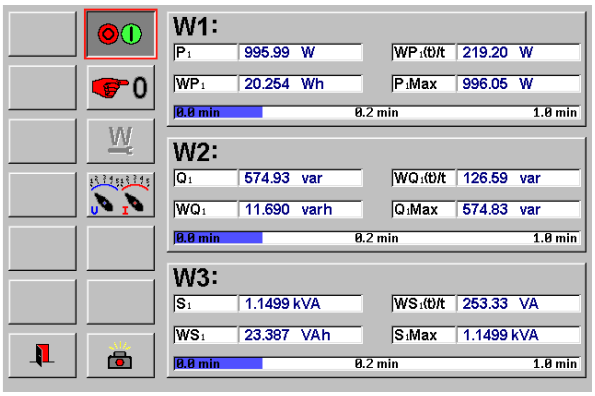


W Energy measurement

123,45 Register test

8.5.1 W Energy measurement

This function serves to do simple energy measurements in one of the available power modes with manual start and stop.



Start energy measurement

Reset and restart energy measurement

Setup energy measurement menu [8.5.1.1]

Voltage and current range settings menu [8.1.1]

W	Call **Setup energy measurement** menu [8.5.1.1]
U I	Call **Range settings** menu [8.1.1]

Display of values

W1: P1 995.99 W WP1(t)/t 219.20 W WP1 20.254 Wh P1Max 996.05 W 0.0 min 0.2 min 1.0 min	**Display for one energy measurement**
P1 995.99 W	**Actual power**

The actual power of the selected energy mode is displayed.

WP1 20.254 Wh	**Actual energy**

The actual energy of the selected mode is displayed. The energy is counted up, starting at zero, displayed with the selected unit.



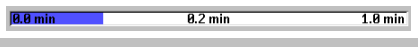
Actual power per measure period

Actual power of the selected mode is displayed. The value shows the energy counted since start of period (WP_1/t) divided by the maximum period (t).



Maximum value

When the first measuring period is finished, power value is shown. At the end of the next measuring period, the new power value is displayed. The value, however, only varies if the new power value is larger than all preceding ones.



Time bar graph for measuring period

A time bar graph shows the progression of the measuring period.
The next measuring period starts automatically.



Start Energy measurement

Start the energy measurement after definitions are made in
Setup Energy measurement.  menu [8.5.1.1]

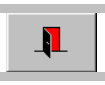


Restart Energy measurement

With the FB  the counting registers are reset to zero. Counting restarts automatically.

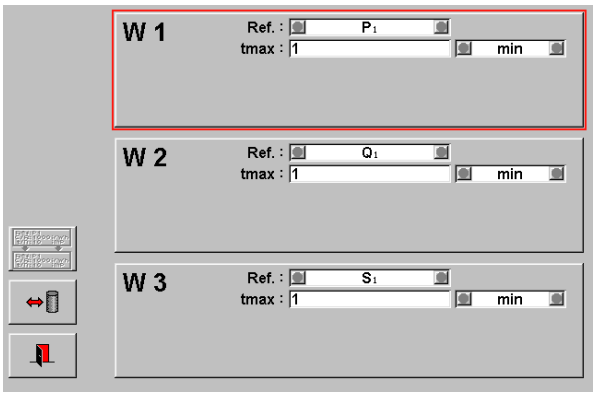


Call **storage and printout of test results** menu [10].



Exit, back to calling menu

8.5.1.1 Setup Energy measurement



Copy parameters from field x (1,2,3) to field y (1,2,3**)**

Load/save settings from/to directory[4.4]

Selection of the source power for the energy measurement.

Enter of time period for maximum registration

Ref. : P1	**Selection of the reference power for energy measurement**

P1	Active power
Q1	Reactive power
S1	Apparent power
-- OFF --	Input switched OFF, no measurement

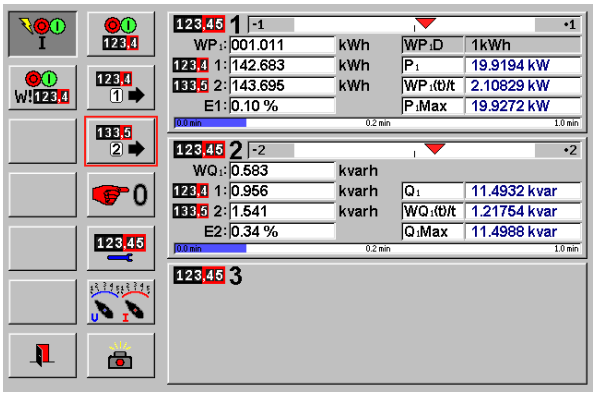
t : 1 min	**Time period**

For the maximum measurement, the user is asked for a measuring period.
Time base in minutes for maximum registration.

	Copy parameters from field x (1,2,3) to field y (1,2,3)
	Load/save settings from/to directory Load [4.4]
	Exit, back to calling menu

8.5.2 Register test

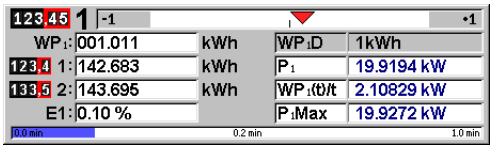
The register or counter test function is used to test the correct indication of the registers on mechanical or electronic meters.



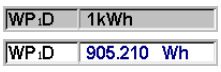
- Switch power source on/off (I, U or U+I)
- Start or stop automatic register test
- Start or stop energy measurement
- Enter start reading of register
- Enter end reading of register
- Reset register test
- Setup Register Test menu [8.5.2.1]
- Range settings menu [8.1.1]

123.45	Call **Setup Register Test** menu [8.5.2.1]
U I	Call **Range settings** menu [8.1.1]

Indications / Entries

	**Indications for one energy register**
	**Tolerance band**

Predefined upper and lower tolerances with graphical indicated error.

	**Predefined energy for register test**

The grey marked field shows the predefined energy, as defined in the **Setup register test** menu [8.5.2.1].
After starting the register test, the energy is counting down to zero.

	**Actual power**

The actual power of the selected energy mode is displayed.

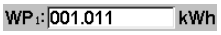
	**Actual power per measuring period**

Actual power of the selected mode is displayed. The value shows the energy counted since start of period ($WP_1(t)$) divided by the maximum period (t).



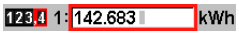
Maximum value

When the first measuring period is finished, power values are also shown in the field P_1Mmax. The next measuring period starts automatically. At the end of the next measuring period, the new power values are displayed. The value, however, only varies if the new power value is larger than all preceding ones.



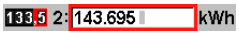
Actual energy

Actual passed energy. The energy is counting up until the register test is stopped.
The number of digits after decimal point is defined by the entry of the start reading.



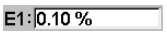
Start reading of register

Any start value can be defined for the register.
The way the value is entered (number of digits after decimal point) is used as register format for the actual energy indication and the input of the end reading and defines the resolution of the error calculation.



End reading of register

Entering of the end reading, when the register test has finished or during the test to enter the expexted end reading before the register test has finished.



Register Error

The register error is calculated based on the measured energy (WP1) and the entered start (1:) and end (2:) readings.

Note: The digits entered after decimal point at the start reading define the resolution for the error calculation. E.g. the format 0.001 kWh at a dosage energy of 1 kWh gives a resolution of the error of ± 0.1%.
The real measured energy WP_1 is relevant for the error calculation, not the predefined value WP_1D. WP_1 normally is a little bitter higher than the predefined value WP1D, because energy is also measured during the source is switched off with a ramp.



Time bar graph for maximum measuring period

A time bar graph shows the progression of the measuring period.
The next measuring period starts automatically.
This time is only used for Maximum demand test.

Test setup

Before start of the test, the meter under test (MUT) must be connected. Examples for measuring set-ups in different connection and operating modes can be found in menu [11].

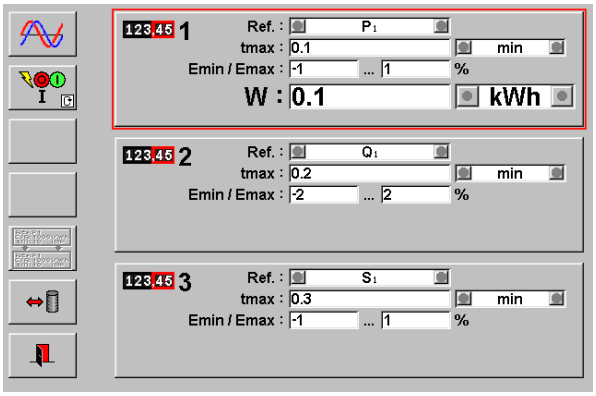
Configuration

Check / change basic settings and configurations for register test in setup menu [8.5.2.1]

Step by step instruction

See test procedures for automatic register test [8.5.2.2] or manual register test [8.5.2.3], [8.5.2.4].

8.5.2.1 Setup Register test



Define the load point for the automatic register test

Source action during register test

Define the load point for the automatic dosage

Define the load point in the same way as in the source setup menu or load previously defined saved load point settings.
Note: To speed up the register test it is recommended to operate the meter at maximum power (e.g. Imax and power factor PF1).

Source action during register test

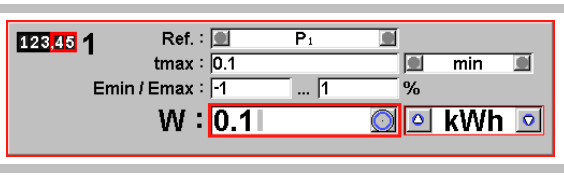
Select the desired status of the voltage and current source, during the register test run.

Only current is switched ON/OFF during the test.
The voltage is always on. The current is switched on/off for the dosage of the desired energy.
This is the most used mode for electronic meters. For reading out the register end values of electronic meters, voltage has to be switched on.

Only voltage is switched ON/OFF during the test.
The current is always on. The voltage is switched on/off for the dosage of the desired energy.

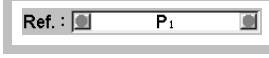
Both, voltage and current are switched ON/OFF during the test.
The source is completely off. Voltage and current are switched on/off for the dosage of the desired energy.
This mode can e.g. be used with electromechanical meters.

Note: Current and voltage are automatically switched on again in modes **Test** and **Reference + Source** after entering the end reading and calculation of the error. This is done to have the possibility to document the load values together with the results with the camera key.

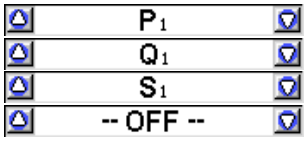


Settings for register test 1

The following settings for Ref., tmax and Emin / Emax can be defined independently for each of the three register tests 1, 2, 3.



Reference power mode for energy measurement and energy dosage



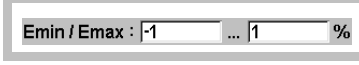
Active power
Reactive power
Apparent power
Register test switched OFF, the corresponding field is blank in the register test main menu.



Maximum demand period

Time period for maximum demand test in minutes (e.g. typical value: 15 min).
This interval must be manually synchronized with the maximum demand period of the meter under test by starting the test with the interval start at the meter.

Hint: The maximum demand test is always running and cannot be switched off. If this is disturbing, a period of 60 min can be entered. In this case $WP_1(t)/t$ will indicate the energy counted up since start in Wh during 1h.



Error tolerance band

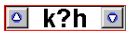
Entry of an upper and lower tolerance between ±0.0000... ±100 %.



Enter the amount of energy (W) for dosage

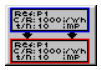


The unit depends on the chosen reference mode. These setting and input can be defined on input 1 only, valid for all three register tests.



In case 

is chosen, the unit is shown **x?x.**

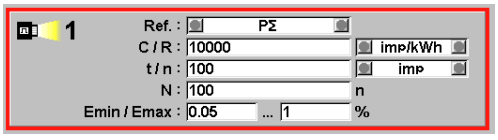


Copy parameters from field x (1,2,3) to field y (1,2,3)

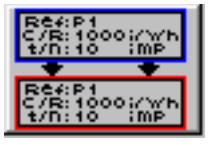
The copy function is enabled, if the regions of two fields are selected at the same time.

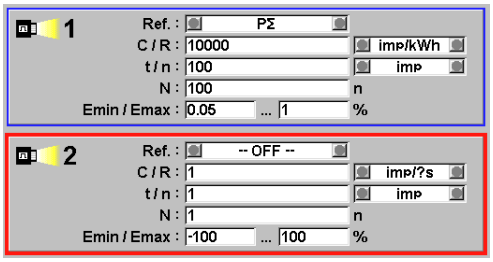
E.g. copy settings of field 1 to field 2





Activate field 1
The red frame is displayed around the region of field 1.





Activate region of field 2 and activate copy function
The red frame is displayed around the region of field 2. The frame around region of field 1 becomes blue.

The copy key is enabled. By pressing the copy key all settings are copied from the field with the blue frame to the field with the red frame. The copy function can be repeated, by selecting the region of field 3 or field 1. The last input region selected always becomes the copy destination. The field region selected previously is the copy source

	**Load/save** settings from/to directory Counter Test Parameters: menu [4.4]

	**Exit, back to calling menu**

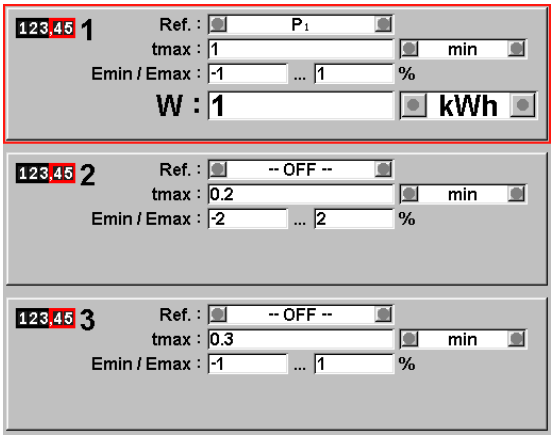
8.5.2.2 Procedure for automatic register test

The following procedure describes an automatic register test of one active energy register in the basic control mode **Test** or **Reference + Source**. The source is switched **automatically** on and off as required by the settings.

1		Call **Setup Register Test** menu [8.5.2.1]

Load predefined settings or check and adapt the actual settings

1.1



Configure register test 1

- Select reference power mode (Ref.) P1 for register test 1 and select -- OFF -- for register tests 2,3.
- Enter desired maximum demand period (tmax), if a maximum demand test should be performed in parallel.
- Define tolerances (Emin/Emax) regarding the class of the meter under test.
- Enter dosage energy (W), e.g. 1 kWh

1.2  Define the **load point** for the automatic register test (e.g. 230V, 100A, 0°).

Attention! During the test these settings are activated, not the actual settings in the source menu. Check that the load point settings are defined and suitable for your meter under test (e.g. I ≤ Imax).

1.3  Select source action mode **current switched on/off**.

1.4  Leave setup menu

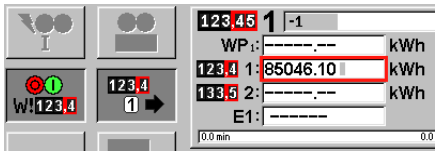
2		**Reset register test**

The result of a previous test are reset to zero.

3		**Start automatic register test**

The FBs for source action and energy measurement are blocked and the voltage is switched on to power up the meter under test.

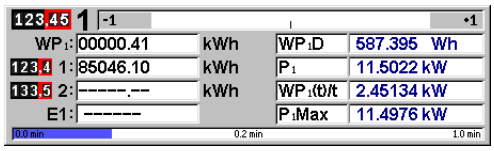
4		**Enter register start reading**



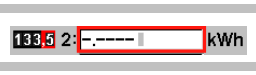
The **input of the start reading** is automatically activated.
Enter the actual register reading as displayed on the meter under test with unit kWh.

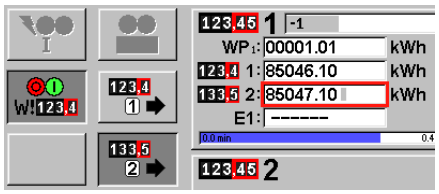
5		**Start of energy dosage**

By pressing the THB to accept the input of the start reading the current is switched on and the dosage runs automatically as defined.



The dosage value WP1D is counting down from initial value to zero.
The reference energy WP1 is counting up with the resolution of the entered start reading.
If the programmed dosage value is reached, the current is switched off.

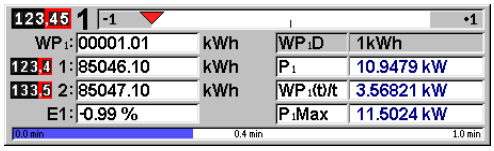
6		**Enter register end reading**



The **input of the end reading** is automatically activated.
Enter the actual register reading as displayed on the meter under test with unit kWh.

7		**Calculation and indication of the register error**

By pressing the THB to accept the input of the end reading the register test is finished.



The error (E1) of the register test is calculated and indicated based on the measured reference energy (WP1) and the entered start (1:) and end (2:) readings.



The current is automatically switched on again for documentation of the load values together with the results with the camera FB.
Note: If this is not desired, the current can be switched off manually by operating this button with the THB.

8		Call **storage and printout of test results** menu [10].

The test result together with the actual load values are frozen at the moment the camera key is pressed and can be saved on the CF card for later analysis and reporting with the software CALSOFT.

Notes
In the same way the test can also be performed for reactive energy or apparent energy only.
To repeat the same test restart with step 2.
Attention! The source remains in the last state, if you leave the register test menu. Voltage and/or current can still be switched on depending on the actual source action settings.

Check the actual state in the source menu card and switch off the source manually, if this is required.

Variations in the automatic procedure

1a, 4a, 6a Test of 2 or 3 registers at the same time

1a The 2 or 3 required register tests must be defined in the setup (1a).

Note: The dosage energy is only defined at register test 1 and is valid for all three register tests. The test will stop for all three register tests, if the energy defined at register test 1 is reached. If active and reactive energy registers are tested at the same time, a suitable load point must be defined (PF ≠ 1) to get active and reactive energy dosage at the same time.

4a,6a During entry of start and end readings the input for all active registers is required one by one, before the next step is running.

4b, 6b Change of start and end readings

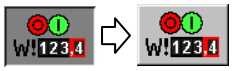
Before the start of the test, as soon as the test is running and also if the test is finished the start and end readings can be changed.

This can be used to:

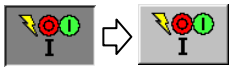
- Correct wrong entries
- Enter an expected end reading
- Test several registers of different meters one by one by entering the corresponding register readings.

5a Stop automatic test

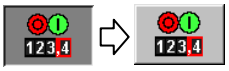
A running automatic test can be stopped any time with following sequence:



Press the **automatic test button** to stop the automatic procedure. The buttons for source control and energy measurement are unblocked.



Press the **source action button** to stop the energy dosage.



Press the **energy measurement button** to stop the energy measurement of the reference standard.

After stopping the energy measurement, the entry of the end reading is automatically activated and the steps (6) and (7) run as normal. The error is calculated with the energy (WP_1) counted since start of the test.

3c, 5c, 6c Automatic test with reference standard only

In the basic control mode **Reference** the register test is a guided energy measurement. There is no automatic dosage performed. The switch on/off of the load must be done manually by the user (e.g. by operating a load circuit breaker or by connecting and disconnecting a load or by manual operation of an external source).



The source action button is blocked all the time, because no source control is available.

3c Energy measurement of the reference standard is automatically started
The load status before the test, e.g. voltage on, must be manually controlled by the user.

5c Dosage is not starting automatically. The user must activate the load, e.g. operate a circuit breaker or switch on a current with an external source manually. As soon as a load is there, the predefined energy is counting down.

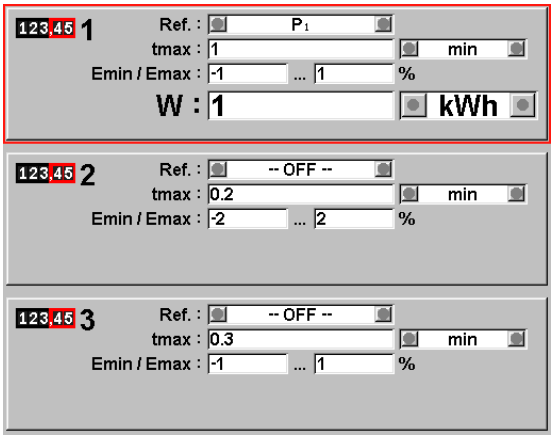
6c The energy measurement is stopped, when the predefined energy is reached and the input of the end reading is activated. The user must stop the load manually at the same time, when the input of the end reading is activated to assure, that the reference standard and the meter under test are counting the same amount of energy.

8.5.2.3 Procedure for manual register test

The following procedure describes a manual register test of one active energy register in the basic control mode **Test** or **Reference + Source**. The source and the energy measurement are controlled **manually** by the user.

1		Call **Setup Register Test** menu [8.5.2.1]

Load predefined settings or check and adapt the actual settings

1.1 

Configure register test 1

- Select reference power mode (Ref.) P1 for register test 1 and select -- OFF -- for register tests 2,3.
- Enter desired maximum demand period (tmax), if a maximum demand test should be performed in parallel.
- Define tolerances (Emin/Emax) regarding the class of the meter under test.

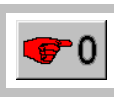
The input of a dosage energy W is not necessary, because this value is not regarded at manual test.

1.2  Define the **load point** for the register test (e.g. 230V, 100A, 0°).

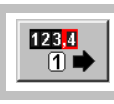
Attention! If the source action button is pressed, these settings are activated, not the actual settings in the source menu. Check that the load point settings are defined and suitable for your meter under test (e.g. I ≤ Imax).

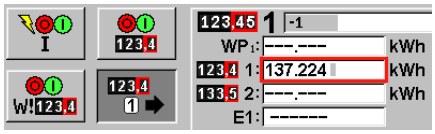
1.3  Select source action mode **current switched on/off**.

1.4  Leave setup menu

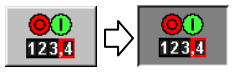
2		**Reset register test**

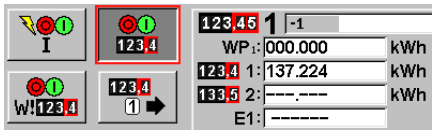
The result of a previous test are reset to zero.

3		**Enter start reading**

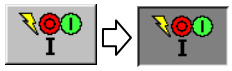


Enter the actual register reading as displayed on the meter under test with unit kWh.

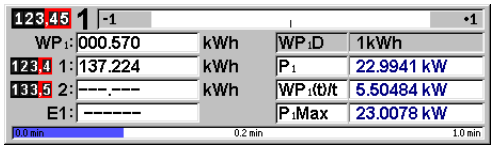
4		**Start energy measurement**



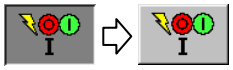
The energy measurement of the reference meter is enabled and the energy will be counted and shown at WP_1 as soon as a load is present.

5		**Switch power source on**

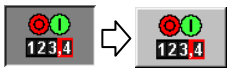
The current is switched on and the energy dosage is running until it is stopped manually.



The reference energy WP_1 is counting up with the resolution of the entered start reading.
The dosage value WP_1D is shown grey and remains unchanged, because this value is not regarded in the manual mode.

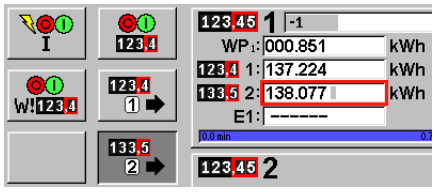
6		**Switch power source off**

The current is switched off. Wait with the next step until the source is completely switched off.

7		**Stop energy measurement**

The energy measurement of the reference is stopped.

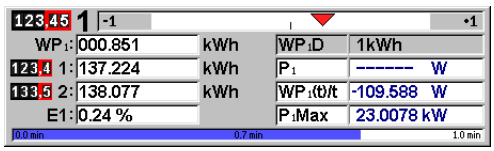
8		**Enter register end reading**



The **input of the end reading** is automatically activated. Enter the actual register reading as displayed on the meter under test with unit kWh.

9		**Calculation and indication of the register error**

By pressing the THB to accept the input of the end reading the register test is finished.



The error (E1) of the register test is calculated and indicated based on the measured reference energy (WP_1) and the entered start (1:) and end (2:) readings.

8		Call **storage and printout of test results** menu [10].

The test result together with the actual load values are frozen at the moment the camera key is pressed and can be saved on the CF card for later analysis and reporting with the software CALSOFT.

Notes
In the same way the test can also be performed for reactive energy or apparent energy only.
To repeat the same test restart with step 2.

Attention! The source remains in the last state, if you leave the register test menu. Voltage and/or current can still be switched on depending on the actual source action settings.
Check the actual state in the source menu card and switch off the source manually, if this is required.

Variations in the manual procedure

1a, 3a, 8a	**Test of 2 or 3 registers at the same time**

1a The 2 or 3 required register tests must be defined in the setup (1a).
Note: If active and reactive energy registers are tested at the same time, a suitable load point must be defined (PF ≠ 1) to get active and reactive energy dosage at the same time.

3a,8a During entry of start and end readings the input for all active registers is required one by one, before the next step is running.

3b, 8b	**Change of start and end readings**

Before the start of the test, as soon as the test is running and also if the test is finished the start and end readings can be changed.

This can be used to:

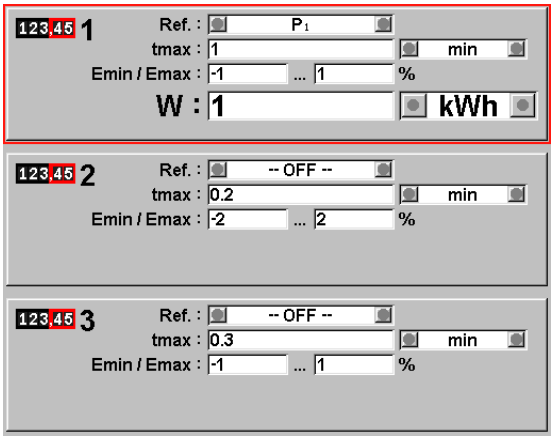
- Correct wrong entries
- Enter an expected end reading
- Test several registers of different meters one by one by entering the corresponding register readings.

8.5.2.4 Procedure for manual register test with reference meter only

The following procedure describes a manual register test of one active energy register in the basic control mode **Reference**. The energy measurement of the reference standard and the test load must be controlled **manually** by the user.

1		Call **Setup Register Test** menu [8.5.2.1]

Load predefined settings or check and adapt the actual settings



Configure register test 1

- Select reference power mode (Ref.) P1 for register test 1 and select -- OFF -- for register tests 2,3.
- Enter desired maximum demand period (tmax), if a maximum demand test should be performed in parallel.
- Define tolerances (Emin/Emax) regarding the class of the meter under test.

The input of a dosage energy W is not necessary, because this value is not regarded at manual test.

The definition of the load point and the source action mode is not necessary, because no source is controlled in mode **Reference**.

 Leave setup menu

2		Call **Range settings** menu [8.1.1]

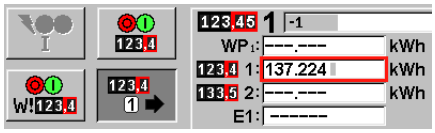
Set manual range selection and select voltage and current ranges next higher to the maximum values of current and voltage reached during the test.
This is to prevent additional errors introduced through the automatic range switching of the reference standard during switch on/off procedure of the load.

Note: It is recommended to use automatic range selection only, if the peak values of voltage and current reached during the test are not known and if the test duration is long compared to the switch on/off procedure, where this influence can be neglected (e.g. long duration test on site with customer load).

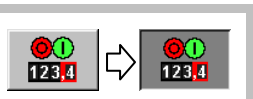
3		**Reset register test**

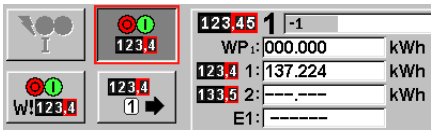
The result of a previous test are reset to zero.

4		**Enter start reading**



Enter the actual register reading as displayed on the meter under test with unit kWh.

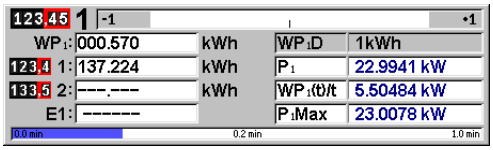
5		**Start energy measurement**



The energy measurement of the reference meter is enabled and the energy will be counted and shown at WP_1 as soon as a load is present.

6	**Switch on the load**

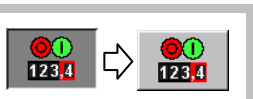
Manually switch on an external source or switch on a circuit breaker or connect a load to dose some energy.



The reference energy WP_1 is counting up with the resolution of the entered start reading.
The dosage value WP_1D is shown grey and remains unchanged, because this value is not regarded in the manual mode.

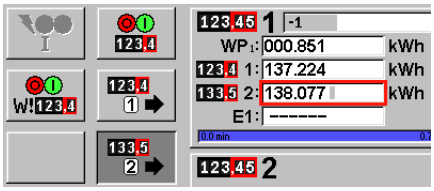
7	**Switch off the load**

Manually switch off an external source or switch off a circuit breaker or disconnect a load to stop the energy flow.

8		**Stop energy measurement**

The energy measurement of the reference is stopped.

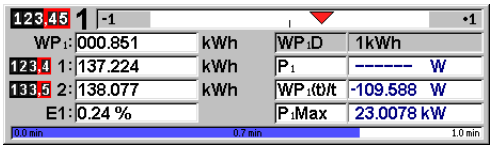
9		**Enter register end reading**



The **input of the end reading** is automatically activated. Enter the actual register reading as displayed on the meter under test with unit kWh.

10		**Calculation and indication of the register error**

By pressing the THB to accept the input of the end reading the register test is finished.



The error (E1) of the register test is calculated and indicated based on the measured reference energy (WP_1) and the entered start (1:) and end (2:) readings.

Notes
In the same way the test can also be performed for reactive energy or apparent energy only.
To repeat the same test restart with step 3.

1a, 3a, 8a Test of 2 or 3 registers at the same time

1a The 2 or 3 required register tests must be defined in the setup (1a).

Note: If active and reactive energy registers are tested at the same time, a suitable load must be available (PF ≠ 1) to get active and reactive energy dosage at the same time.

4a,9a During entry of start and end readings the input for all active registers is required one by one, before the next step is running.

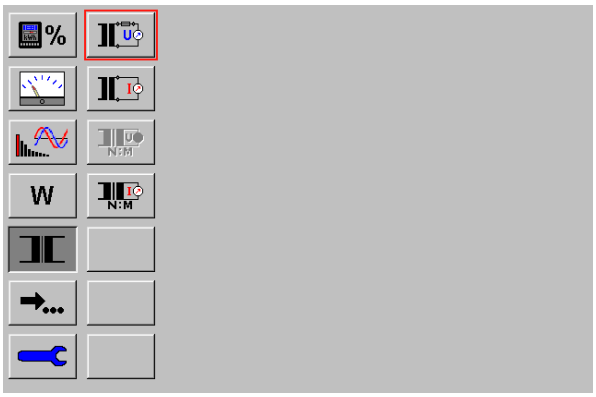
4b, 9b Change of start and end readings

Before the start of the test, as soon as the test is running and also if the test is finished the start and end readings can be changed.

This can be used to:

- Correct wrong entries
- Enter an expected start and end reading
  E.g. if the load cannot be controlled, a start reading a little bit higher than the actual reading of the meter register can be entered, and the register test can be started by starting the energy measurement, if this reading is reached at the meter under test. Then an end reading can be entered and the test can be stopped by stopping the energy measurement, if the end reading is reached at the meter under test. In this way no load control is necessary. This method could be applied for on site tests with customer load, which cannot be influenced.
- Test several registers of different meters one by one by entering the corresponding register readings.

8.6 Instrument Transformer Testing



PT burden measurement

CT burden measurement

PT ratio measurement (not available)

CT ratio measurement

8.6.1 Potential Transformer (PT) burden measurement

The rated secondary voltage (Un) and rated burden (SN) of the potential instrument transformer (PT) must be entered. These values can normally be found on the nameplate of the transformer.

Optionally the influence of the wires between secondary side of the transformer and the measuring point can be regarded by entering resistance of fuse and junctions (RF), length (l) and cross section (A) of the wire.

The PTS 3.1 C measures the burden current (I), the actual secondary voltage (U) and the burden factor (cos).

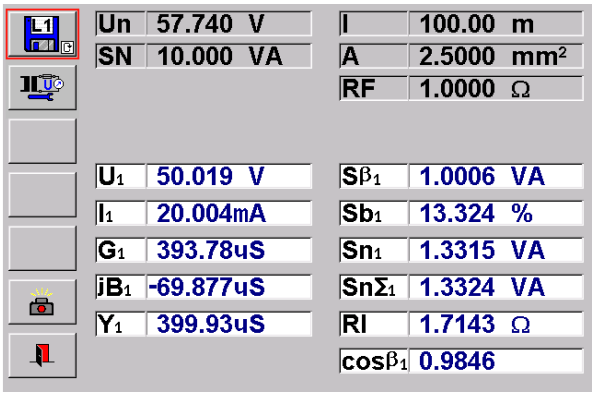
As main result the ratio (Sb) of total rated operating burden (SnΣ) to rated burden (SN) is calculated and indicated in %.

Regarding the international standard IEC 60044-2 the Sb value should be in the range:

25 % SN ≤ Sb ≤ 100 % SN

After the exchange of a mechanical meter with an electronic meter in a substation the burden of the voltage measurement transformer is often too low and measures must be taken to raise the burden to be in the admissible range again.

For the necessary connections between transformer and instrument see the connection example in chapter [11].



PT burden measurement menu

The measurement starts immediately and is continuously running with the actual parameter settings shown in the upper part of the display.

The measured and calculated results are updated in the interval of the time base.

Assign results to phase L1, L2 or L3 (can be used for test of a 3 phase meter phase by phase)

Settings for PT burden measurement

Call **storage and printout of test results** menu [10].

Exit, back to calling menu

Parameter settings

Un	57.740 V
SN	10.000 VA

Voltage transformer parameters
Rated secondary voltage (UN) and rated burden (SN) of voltage transformer

l	100.00 m
A	2.5000 mm²
RF	1.0000 Ω

Influence parameters (optional)
Parameters to regard the influence of the length (l) and cross section (A) of the wire and of junctions and fuses (RF) between test point and transformer secondary side on the total burden.

Results

U_1	50.019 V

Secondary voltage The actual measured secondary voltage of the voltage transformer

I_1	20.004mA

Burden current The actual measured current into the burden of the voltage transformer

$S\beta_1$	1.0006 VA

Measured burden

The real burden with actual load condition. This value cannot be directly compared to the rated nominal burden (SN). Therefore this value has not high importance.

Measured burden
$S\beta 1 = U1 \cdot I1$

Sb_1	13.324 %

Operating burden ratio

The ratio between calculated total rated operating burden to the entered rated burden is indicated in %.

The value should be in the range: **25 % SN ≤ Sb ≤ 100 % SN**

If the value is not in the admissible range measures can be taken on site to adjust the burden and the effect can immediately be checked.

Operating burden ratio in %
$Sb = \frac{Sn\Sigma}{SN} \cdot 100[\%]$

$\cos\beta_1$	0.9846

Burden factor

Ratio of real part (G) to admittance (Y).The value is calculated based on the measured values U and I.

Burden factor	Phase angle of burden
$\cos\beta = \frac{G}{Y}$	$\beta = \cos^{-1}\left(\frac{G}{Y}\right) = \tan^{-1}\left(\frac{B}{G}\right)$

Sn_1	1.3315 VA

Rated operating burden

Burden related to the rated voltage, calculated with the measured admittance (Y) and the entered rated voltage (UN). This value can directly be compared with the rated burden specified by the manufacturer (SN). Because the calculation of SN is based on the admittance (Y), the

measurement is independent of the actual secondary voltage (U). The secondary voltage (U) can be different from the rated value (UN). The result remains the same.

Rated operating burden
$Sn = UN^2 \cdot Y = UN^2 \cdot \frac{I}{U}$

$Sn\Sigma_1$	1.3324 VA
Rl	1.7143 Ω

Total rated operating burden
Resistance of wire, fuse and junctions

Burden related to the rated voltage with regard of voltage drops between secondary connections of the voltage transformer and the measuring point of the secondary voltage (U).

The voltage drop is calculated with the optional entries for length (l) of wire from measuring point to transformer and back and cross section (A) of the wire. Additional the entered value RF for fuse and junctions will be regarded.

Total rated burden	Resistance of wire, fuse and junctions
$Sn\Sigma = UN^2 \cdot \left(Y + \frac{1}{Rl} \right)$	$Rl = \rho \cdot \frac{l}{A} + RF$

If RF, A and l are zero: SnΣ = Sn

G_1	393.78uS
jB_1	-69.877uS
Y_1	399.93uS

Conductance (real part of Y)
Susceptance (imaginary part of Y)
Admittance Y

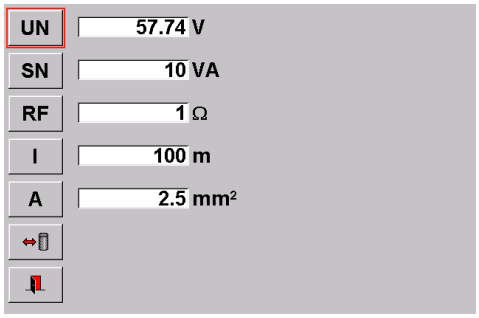
The admittance (Y) and its real part (G) and imaginary part (jB) are calculated based on the measured values U and I.

Admittance	Complex Admittance
$Y = \frac{I}{U} = \sqrt{G^2 + B^2}$	$\underline{Y} = \frac{\underline{I}}{\underline{U}} = G + jB$



Assign results to phase L1, L2, L3

Select L1, L2, L3 to assign the measured results (U1, I1) to the corresponding phase (cyclical mode).
The calculated results are indicated with the index of the selected phase. This function can be used to test and save the results of a 3 phase meter phase by phase.



To perform the measurement, the nominal values of the potential transformer (PT) must be entered:

UN Rated secondary voltage in **V**

SN Rated burden in **VA**

This information can be found on the name plate or the calibration certificate of the transformer.

Load/save settings

Exit, back to calling menu

If the voltage cannot be measured directly at the secondary side of the voltage transformer, the influence of the wires between measuring point and transformer and the influence of fuses and junctions to the total burden can be regarded by entering values at l, A and RF. The entries are regarded for the calculation of **Rl** and **SnΣ**.

The entries l, A and RF are optional and should be set to zero, if not used.

RF Resistance of fuses and junctions between measuring point and transformer in Ω.

I Total length of conductor from measuring point to voltage transformer and back to measuring point in **m**.

A Cross section of conductor between measuring point and voltage transformer in **mm²**.

Resistivity of copper (ρ)	Resistance Rl
$\rho = 17.857 \left[\frac{m\Omega \cdot mm^2}{m} \right]$	$Rl = \rho \cdot \frac{l}{A} + RF$

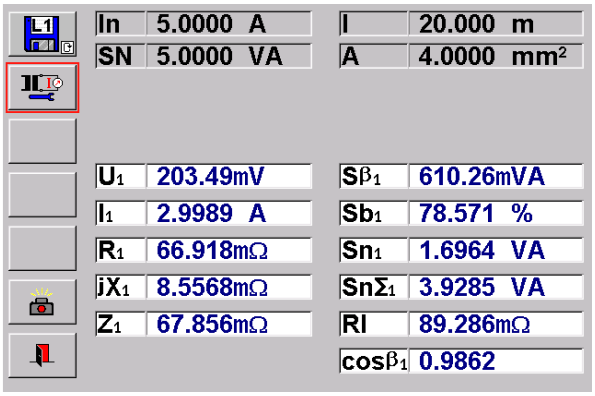
8.6.2 Current Transformer (CT) burden measurement

The rated secondary current (IN) and rated burden (SN) of the current instrument transformer must be entered.
Optionally the influence of the wires between secondary side of the transformer and the measuring point can be regarded by entering length (l) and cross section (A) of the wire.
The PTS 3.1 C measures the actual secondary current (I), the burden voltage (U) and the burden factor (cos).
As main result the ratio (Sb) of total rated operating burden (SnΣ) to rated burden (SN) is calculated and indicated in %.
Regarding the international standard IEC 60044-1 the Sb value should be in the range:

25 % SN ≤ Sb ≤ 100 % SN

After the exchange of a mechanical meter with an electronic meter in a substation the burden of the current measurement transformer is often too low and measures must be taken to raise the burden to be in the admissible range again.

For the necessary connections between transformer and instrument see the connection example in chapter [11].



CT burden measurement

The measurement starts immediately and is continuously running with the actual parameter settings shown in the upper part of the display.

The measured and calculated results are updated in the interval of the time base.

Assign results to phase L1, L2 or L3 (can be used for test of a 3 phase meter phase by phase)

Settings for CT burden measurement

Call **storage and printout of test results** menu [10].

Exit, back to calling menu

Indications / settings

Parameter settings

In	5.0000 A
SN	5.0000 VA

Current transformer parameters
Rated secondary current (IN) and rated burden (SN) of current transformer

l	20.000 m
A	4.0000 mm²

Influence parameters (optional)
Parameters to regard the influence of the length (l) and cross section (A) of the wire between test point and transformer secondary side on the total burden.

Results

U1	203.49mV

Burden voltage The actual measured burden voltage of the current transformer.

I1	2.9989 A

Secondary current The actual measured secondary current of the current transformer.

Sβ1	610.26mVA

Measured burden

The real burden with actual load condition. This value cannot be directly compared to the rated nominal burden (SN). Therefore this value has not high importance.

Measured burden

$$S\beta 1 = U1 \cdot I1$$

Sb1	78.571 %

Operating burden ratio

The ratio between calculated total rated operating burden to the entered rated burden is indicated in %.

The value should be in the range: **25 % SN ≤ Sb ≤ 100 % SN**

If the value is not in the admissible range measures can be taken on site to adjust the burden and the effect can immediately be checked.

Operating burden ratio in %

$$Sb = \frac{Sn\Sigma}{SN} \cdot 100[\%]$$

$\cos\beta_1$	0.9862

Burden factor

Ratio of real part (R) to impedance (Z).The value is calculated based on the measured values U and I.

Burden factor	Phase angle of burden
$\cos\beta = \frac{R}{Z}$	$\beta = \cos^{-1}\left(\frac{R}{Z}\right) = \tan^{-1}\left(\frac{X}{R}\right)$

Sn_1	1.6964 VA

Rated operating burden

Burden related to the rated current, calculated with the measured impedance (Z) and the entered rated current (IN). This value can directly be compared with the rated burden specified by the manufacturer (SN). Because the calculation of SN is based on the impedance (Z), the measurement is independent of the actual secondary current (I). The secondary current (I) can be different from the rated value (IN). The result remains the same.

Rated operating burden
$Sn = IN^2 \cdot Z = IN^2 \cdot \frac{U}{I}$

$Sn\Sigma_1$	3.9285 VA
Rl	89.286mΩ

Total rated operating burden
Resistance of wire and junctions

Burden related to the rated current with regard of voltage drops between secondary connections of the current transformer and the measuring point of the burden voltage (U).

The voltage drop is calculated with the optional entries for length (l) of wire from measuring point to transformer and back and cross section (A) of the wire.

Total rated operating burden	Resistance of wire
$Sn\Sigma = IN^2 \cdot (Z + Rl)$	$Rl = \rho \cdot \frac{l}{A}$

If A and l are zero: $Sn\Sigma = Sn$

R_1	66.918mΩ
jX_1	8.5568mΩ
Z_1	67.856mΩ

Resistance (real part of Z)
Reactance (imaginary part of Z)
Impedance Z

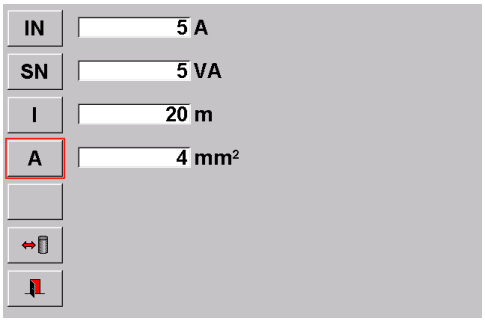
The impedance (Z) and its real part (R) and imaginary part (jX) are calculated based on the measured values U and I.

Impedance	Complex Impedance
$Z = \frac{U}{I} = \sqrt{R^2 + X^2}$	$\underline{Z} = \frac{\underline{U}}{\underline{I}} = R + jX$

Assign results to phase L1, L2, L3

Select L1, L2, L3 to assign the measured results (U1, I1) to the corresponding phase (cyclical mode).
The calculated results are indicated with the index of the selected phase. This function can be used to test and save the results of a 3 phase meter phase by phase.

Parameter settings for burden measurement I



To perform the measurement, the nominal values of the current transformer (CT) must be entered:

IN Rated secondary current in **A**

SN Rated burden in **VA**

This information can be found on the name plate or the calibration certificate of the transformer.

Load/save settings

Exit, back to calling menu

If the burden voltage cannot be measured directly at the secondary side of the current transformer, the influence of the wires between measuring point and transformer and the influence of junctions to the total burden can be regarded by entering values at I, A. The entries are regarded for the calculation of **Rl** and **SnΣ**.

The entries I, A are optional and should be set to zero, if not used.

I Total length of conductor from measuring point to current transformer and back to measuring point in **m**.

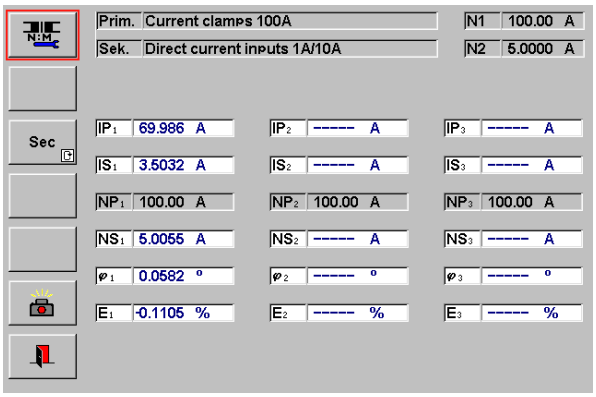
A Cross section of conductor between measuring point and current transformer in **mm²**.

Resistivity of copper (ρ)	Resistance Rl
$\rho = 17.857 \left[\frac{m\Omega \cdot mm^2}{m} \right]$	$Rl = \rho \cdot \frac{l}{A}$

8.6.3 Current Transformer (CT) ratio measurement

This function is used to measure the transformer ratio of current transformers. The kind of current measurement, direct or with clamp-on current transformers, can be selected for primary and secondary input.

Current transformer ratio



Reference for current ratio calculation

Prim

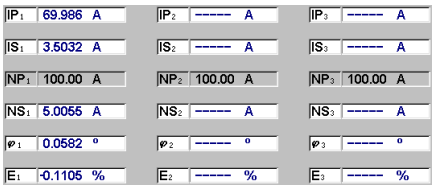
Definition of the reference

Sec

Display of measured primary and secondary values

φ Phase angle in °

Error Ex of the measured ratio / nominal ratio in %



Display of results

Measured primary current **IP** and secondary current **IS**.

Calculated nominal value **NP** or **NS** based on ratio **IPrim/ISec**, depending on the value that is defined as reference.

φ Phase angle in °

Error E of the measured ratio / nominal ratio in %

The results are updated in the interval of the time base T (e.g. 1s).

Nominal ratio

$r_n = NP_n/NS_n$

Measured ratio

r = IP/IS = NP/NS

Ratio error

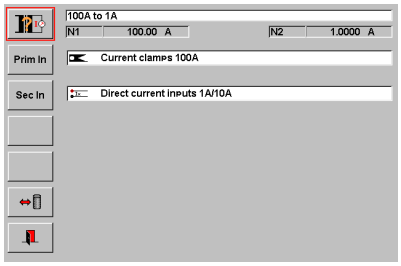
$E = [r/r_n - 1]*100$ [%]

Input of nominal ratio

To calculate the ratio error **E** the specified ratio of the transformers must be defined. This is done by input of primary nominal value **NP** and secondary nominal value **NS** or **nominal ratio** at **NP** with **NS = 1.**

The fields of the **reference** are grey marked and will be the base value for the calculation of NP or NS in the results display section.

Reference for current ratio calculation



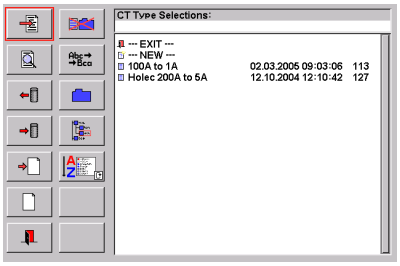
Select / Edit current transformer data

Prim In

Settings for primary and secondary current inputs

Sec In

	**Current Transformer selection**

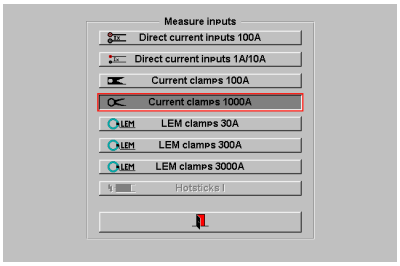


Database current transformer Type
Taking an existing dataset from the directory CT Type.

Editing a CT type data set.

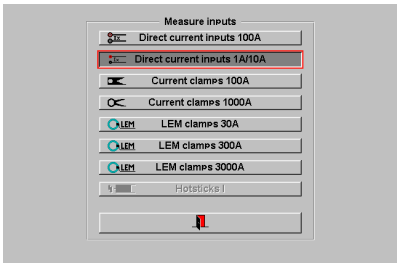
Prim In	**Primary current measurement input**

The definition must be different for primary and secondary input, otherwise the measurement is not started.



Definition of primary current input
First the kind of measurement, direct or with clamps, must be defined for the primary current **Ip, primary input.**

Sec In	**Secondary current measurement input**



Definition of secondary current input
First the kind of measurement, direct or with clamps, must be defined for the secondary current **Is, secondary input** of the current transformers.

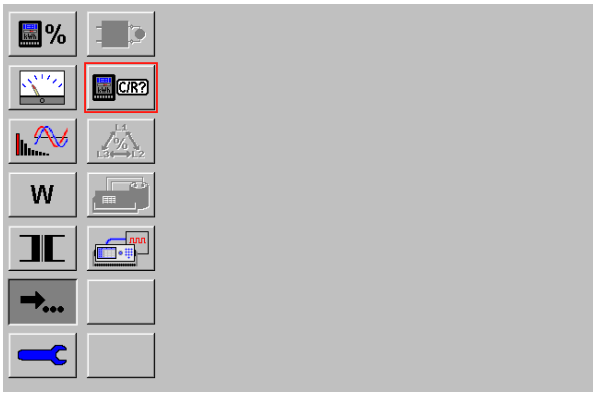
	**Load/save** settings from/to directory

	**Exit, back to calling menu**

	Call **storage and printout of test results** menu [10].

	**Exit, back to calling menu**

8.7 Special functions



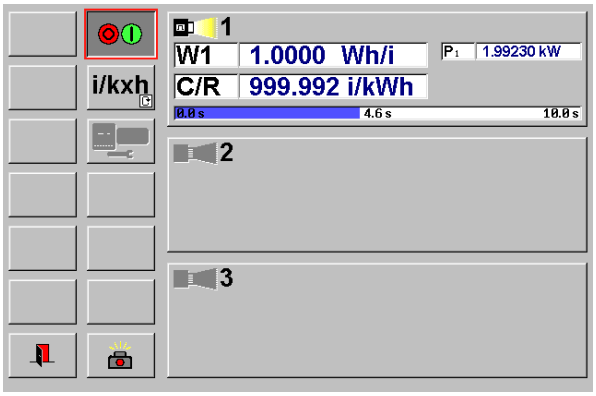
Special functions menu

- AC/DC transducer test (not available)
- Measurement of impulse constant [8.7.1]
- Self test (not available)
- URef test (not available)
- fRef test [8.7.2]

8.7.1 Measurement of impulse constant

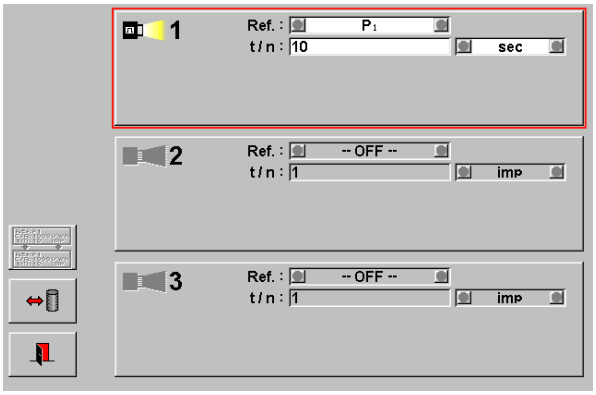
A predefined number of impulses (1 up to n) of a scanning head, hand switch or other impulse source is counted at the impulse input and compared with the energy measured by the internal reference standard from start impulse to impulse n. This reference energy is divided by the tested number of impulses to calculate the approximate impulse constant of the impulse source.

This function helps to find the correct meter constant for the error measurement, if the constant is not clearly indicated on the device under test (e.g. when testing transformer operated meters, where only the primary constant is indicated, but no CT and/or PT ratio or additional factors must be regarded or when testing reference standards, where the specification for the impulse output is missing).



Measurement of impulse constant
The function works in the same way as the error measurement (see also [8.2]).

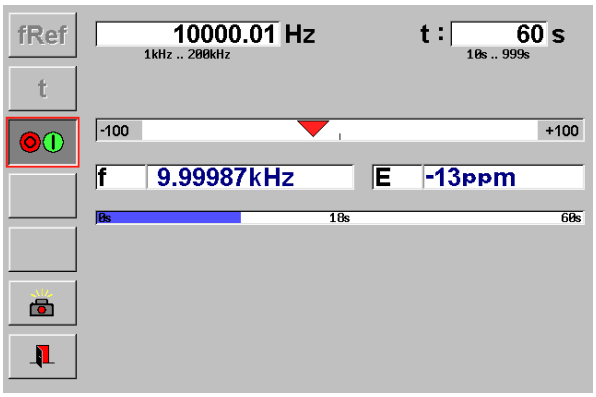
- Start / Stop measurement
- Change unit of constant (i/kxh, i/xh, i/xs, kxh/i, xh/i xs/i with x = W, var, VA)
- Call parameter setup menu
- Call storage and printout menu [10]
- Exit, back to calling menu



Parameters for measurement of impulse constant
Reference power (Ref.) and number of impulses or time to test (t/n) can be defined in the same manner as at error measurement (see also [8.2.2])

- Load/save settings from/to directory
- Exit, back to calling menu

8.7.2 fRef test



Verification against fRef

The stability of the built in time base can be verified by this test.

The output of a frequency standard must be connected to the impulse input 1.

Enter the exact test frequency value **fRef** and the test time **t.**

Frequency range: 1 kHz … 200 kHz

The measurement runs continuously. A bar graph indicates the progress of the measurement.

The deviation of the internal time base is indicated in ppm in graphical form and as a numerical value.

1	**Preparation**

The measuring set-up should be in accordance with the connection example shown in chapter [ ]. The impulse input 1 on PTS 2.3 C must be connected. Any instructions given in the user manual of the Frequency standard should be followed and the measuring set-up adapted if necessary.

2	fRef	Input of reference frequency



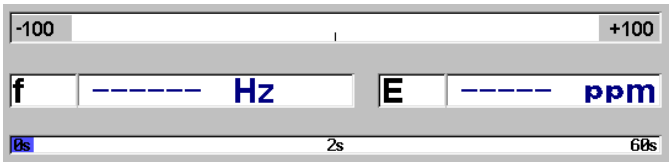
The frequency must be in the range:
1 kHz … 200 kHz

3	t	Input of duration of test

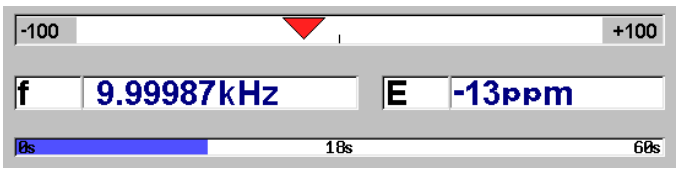


The measuring time must be in the range:
10 s ... 999 s

4		Start fRef test



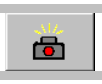
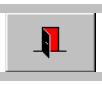
Test starts



After the test duration the deviation of the internal time base is indicated in ppm in graphical form and as a numerical value.

The measurement runs continuously.

5		Stop fRef test

6		Save test results
7		Exit, back to calling menu

9. Sequence Automatic test run with portable test system



Sequence menu card
The sequence menu allows to define test sequences for the two functions:

- Error measurement and
- Energy measurement (register test)

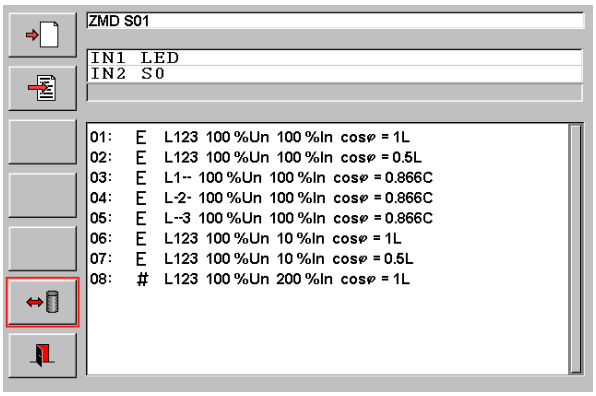
and to run them automatic or step by step on a portable test system.

Note: The test sequence function can only be used for Portable Test Systems with both Reference Standard and Power Source integrated and active.

Indications / settings

	Run automatic or step by step test [9.2]
	Create / edit test sequence [9.1]

9.1 Create / edit test sequence



Basic menu
The three white display areas show top down:

- File name of actual test sequence
- Comment
- Steps of actual test sequence

At the first call all fields are empty.
Following functions can be executed in this menu:

- Reset and edit test sequence
- Edit actual test sequence
- Load / save test sequence
- Exit, back to calling menu

Indications / settings

	Call **test sequence editor** menu [9.1.1]
	Load / save test sequence from / to directory **Check Sequence Selections** [4.4, 6]

The test steps are numbered in the sequence they are executed.

Type

E Error measurement
\# Energy measurement (register test)

Test step name

The automatically generated name indicates the active current phases and the load point settings of the test step.

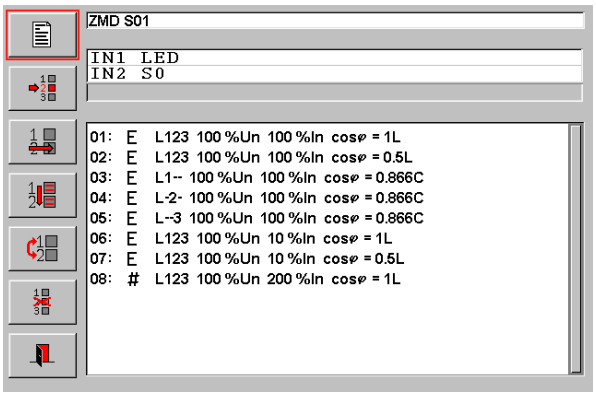
Voltage, current and phase angle settings

L--- 0 V 0 A φ = 0°	Test step with fix settings for UIφ (empty step)
L123 100 %Un 200 %In cosφ = 1L	Percentage settings in relation to nominal values Un, In of meter type, phase angle defined with power factor

Activated current phases

L---	No phase active (empty step)
L123	All phases 1, 2, 3 active
L-2-	Only phase 2 active

9.1.1 Editor functions

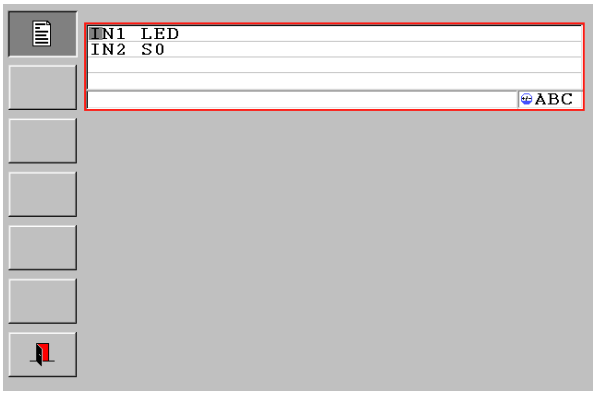


Test sequence editor menu

The right side of the display looks like the basic menu [9.1], only the FB's on the left side are changed and the following functions are available:

- Enter comment
- Insert new step
- Edit step
- Copy step
- Move step
- Delete step
- Exit, back to basic menu

Enter comment



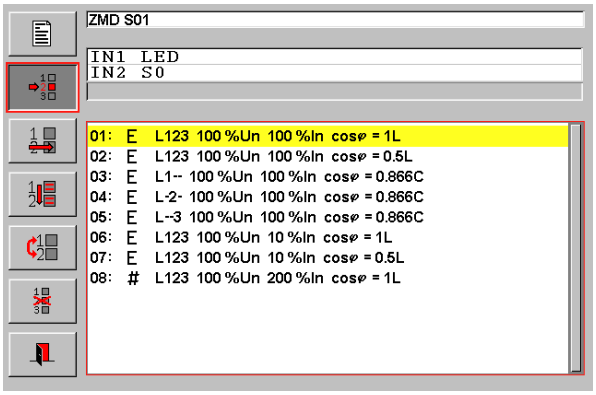
Comment menu
The comment display changes from reduced two to full four line display. Any comment related to the test sequence can be entered.

The following FB's are available:

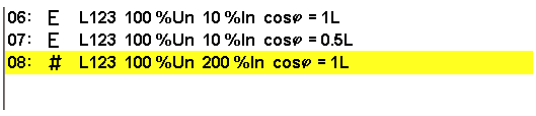
- Enter comment
- Exit, back to editor menu

Basic editor functions

Common functions for the listed FB's (example shown for insert new step):



Activate function
Select and activate FB with THB. The FB is shown depressed. A red frame surrounds the test step window and a yellow selection line is shown on position 1.



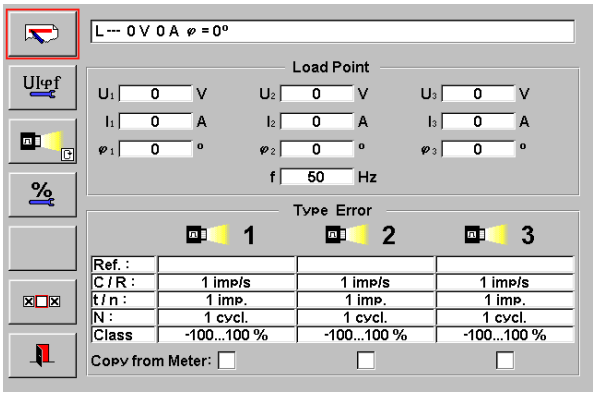
Select position
Move yellow line with THB to desired position.



Cancel function
Move yellow line with THB up at the first or down at the last step to cancel the function. The FB is shown normal again.

Insert new step

```
06:  E  L123 100 %Un 10 %In cosφ = 1L
07:  E  L123 100 %Un 10 %In cosφ = 0.5L
08:  #  L123 100 %Un 200 %In cosφ = 1L
```




```
06:  E  L123 100 %Un 10 %In cosφ = 1L
07:  E  L123 100 %Un 10 %In cosφ = 0.5L
08:  E  L--- 0 V 0 A φ = 0°
09:  #  L123 100 %Un 200 %In cosφ = 1L
```

Activate insert
Push on THB at selected position to call the

Test step definition menu [9.1.2]
Select and define:

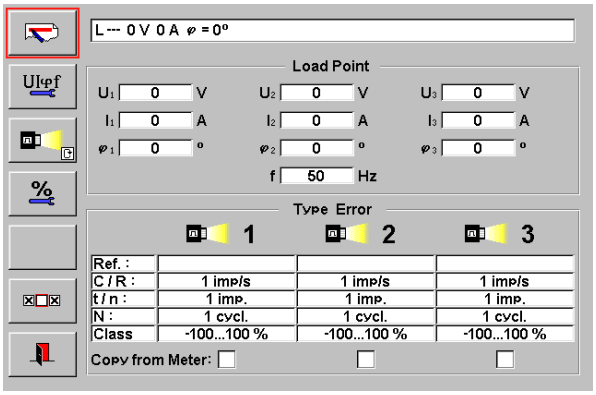
1		Type error **or**
		Type energy
2		Load point setup [9.1.3]
3		Error setup [9.1.4] **or**
		Energy setup [9.1.5]
4		Copy from meter (optional)
5		Exit, back to editor menu

New step inserted
The new test step is inserted at the selected position (08). The old step at this position and all following steps are shifted +1.

Edit step

```
07:  E  L123 100 %Un 10 %In cosφ = 0.5L
08:  E  L--- 0 V 0 A φ = 0°
09:  #  L123 100 %Un 200 %In cosφ = 1L
```

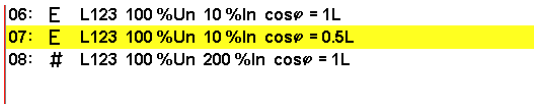
Activate edit
Push on THB at selected position to call the



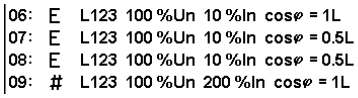
Test step definition menu [9.1.2]
Change settings and name as desired.

Exit, back to editor menu and **terminate edit** function.

Copy step

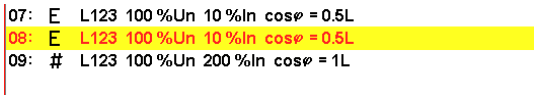


Activate copy
Push TBH at selected position.

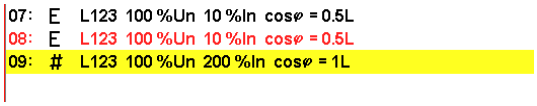


Step copied
The selected step (07) is copied to position +1 (08). The old step at this position and all following steps are shifted +1.

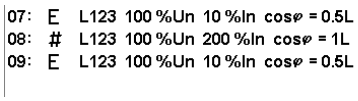
Move step



Mark source position
Push THB at selected position. The test step is marked red.

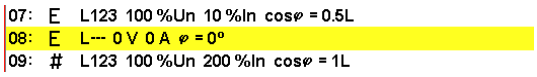


Select target position
Move yellow line with THB to desired position target position.

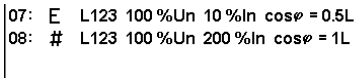


Move position
Push THB at target position to move the marked test step and insert the step behind the step shown at target position.

Delete step

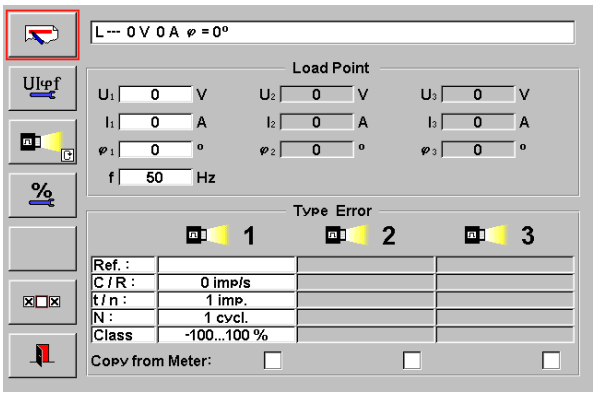


Delete step
Push TBH at the selected position.



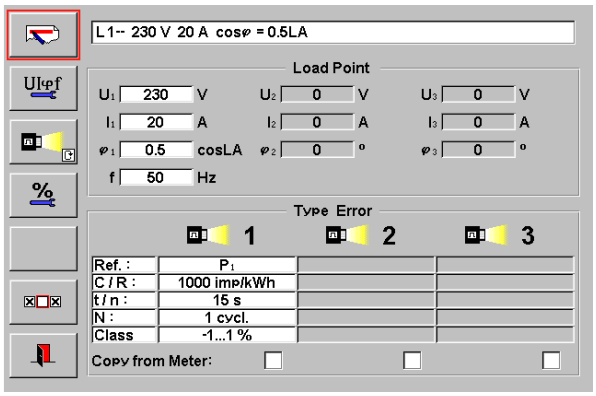
Step deleted
The following positions are shifted -1.

9.1.2 Test step definition



Test step definition menu - new step
The test step name, the load point settings, the error measurement parameters and the status of the copy from meter check boxes are shown.
Functions independent of test step type:

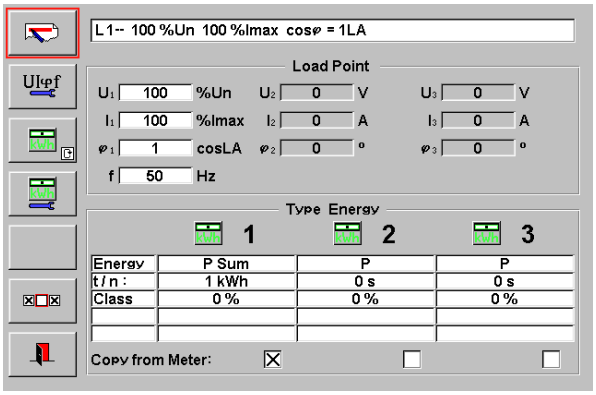
- Test step name
- Load point setup
- Set copy form meter flag
- Exit, back to basic menu



Test step definition menu - Type Error
Functions and indications related to type error:

- Test step type - Error
- Error measurement setup

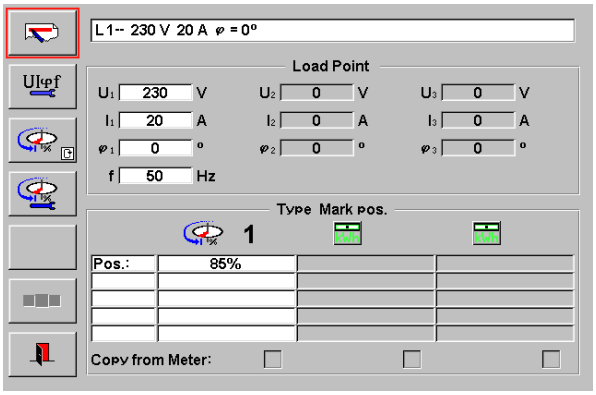
Type Error
In the lower part of the display the error measurement parameters are shown
Load Point
The load point parameters shown are defined with fix settings for voltage and current with units V, A and the phase information as power factor (cosLA). Applicable for all types.



Test step definition menu - Type Energy
Functions and indications related to type energy:

- Test step type - Energy
- Energy measurement setup

Type Energy
In the lower part of the display the energy measurement parameters are shown.
Load Point
The load point parameters shown are defined in the form percentage of meter nominal and maximum values (%Un, %Imax) and the phase information as power factor (cosLA). In this form the test step can be used for different meter types with varying Un, Imax values. Applicable for all types.



Test step definition menu - Type Mark Positioning
Functions and indications related to type mark positioning:

- Test step type – Mark positioning
- Mark positioning setup

Type Mark Positioning
In the lower part of the display the mark positioning parameter is shown.
Load Point
The load point parameters shown are defined with fix settings for voltage, current and phase angle with units V, A,°. Applicable for all types.

Test step name

The system automatically generates a test step name based on the load point setup.
The given name can be changed or any other name can be defined.

Load point setup

The file selection menu is called [6.1].

Load settings
Select and load object file with predefined settings from directory **Load Points Selection**.

Edit settings
The **load point setup** menu is called [9.1.3]
Settings can be entered completely new or loaded settings can be modified.

Test step type

Type Error
Error measurement with 1 input (e.g. LED kWh, LED kvarh or impulse output Wh/i).

Type Energy
Energy measurement (register test) with 1, 2 or 3 counter registers.

Type Mark Positioning
Positioning of the disc mark of mechanical meters in percentage of a full turn (e.g. 85%).

Call **error measurement setup** menu [9.1.4]

Call **energy measurement setup** menu [9.1.5]

Call **mark positioning setup** menu []

Set copy from meter flag

Change settings

Activate function
Push THB to activate function. The FB is shown depressed and a red selection frame is shown.



Change status
Select check box of input 1 to 3 with red frame by turning the THB. Push on THB to change the status of the check box (cyclical mode).

Terminate function
Move red frame back to FB and push the THB to stop the function.

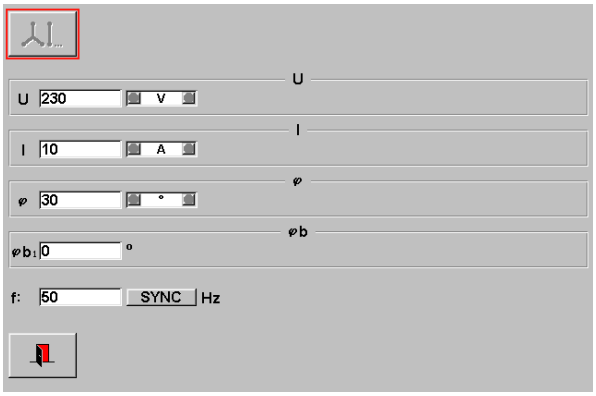
Status of check box

Copy from meter active
The settings in the type error or type energy frame related to the input, where the checkbox is crossed, are copied from the meter, which is defined for this input during the test run.

Note: The test duration (t/n) for type error (imp, s) or type energy (kWh, s) is not copied from the meter. The value must be defined in the test step (initial values: 1 imp, 0 s).

Copy from meter inactive
The settings for type error or type energy as defined in the test step and shown in the frame are used.

9.1.3 Load point setup



Load point setup menu

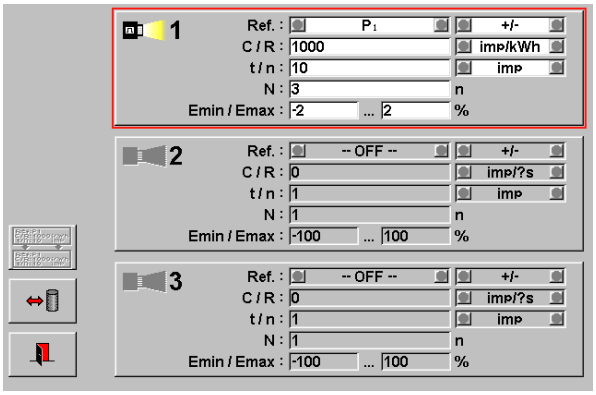
Network selection (not available at PTS3.1C)

Settings for voltage (U) current (I1), phase angle (φ), start phase angle in relation to SYNC (φb1) and frequency (f) or synchronization to line frequency (SYNC) can be selected, modified or entered here.
The settings can be made absolute with unit A, ° or relative as %Un, %In, %Imax. The phase angle can be entered in ° or as power factor in the form cosφLA, cosφLE, sinφLA, sinφLE.

Exit back to calling menu

For a detailed description of load point settings see chapter [7.1.2].

9.1.4 Error measurement setup



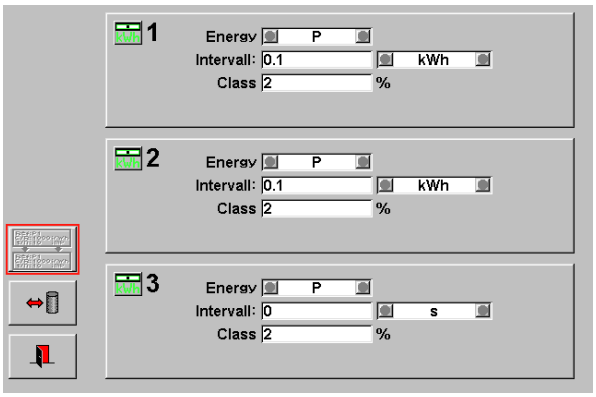
Error measurement setup menu
Settings for reference power/energy mode (Ref.) with sign (+/-), meter constant (C/R), test duration (t/n) in impulses (imp) or seconds(s), number of test repetitions (N) and error tolerance band (Emin/Emax) can be modified or entered here for input 1.

Load /save settings from / to object file in directory

Exit, back to calling menu

For a detailed description of error measurement settings see chapter [8.2.2].

9.1.5 Energy measurement setup



Energy measurement setup menu
Settings for energy type (Energy), test interval in form of energy or time (Interval) and accuracy class in % (Class) can be modified or entered here for inputs 1 to 3.

Load /save settings from / to object file in directory **Counter Test Point Selections**

Copy settings form input x to input y

Exit, back to calling menu

Indications / settings

Energy P **Energy type**

Select energy type with THB or up / down cursors (cyclical mode):

P	Active energy import / export
Q	Reactive energy import / export
S	Apparent energy import / export
P+	Active energy import
P-	Active energy export
Q+	Reactive energy import
Q-	Reactive energy export
Q1	Reactive energy in power quadrant I (P+Q+)
Q2	Reactive energy in power quadrant II (P-Q+)
Q3	Reactive energy in power quadrant III (P-Q-)
Q4	Reactive energy in power quadrant IV (P+Q-)
I^2	I^2-hours (used at transformer loss meters, copper and leakage loss)
U^2	U^2-hours (used at transformer loss meters, iron and core loss)

Intervall: 0.1 kWh **Interval**

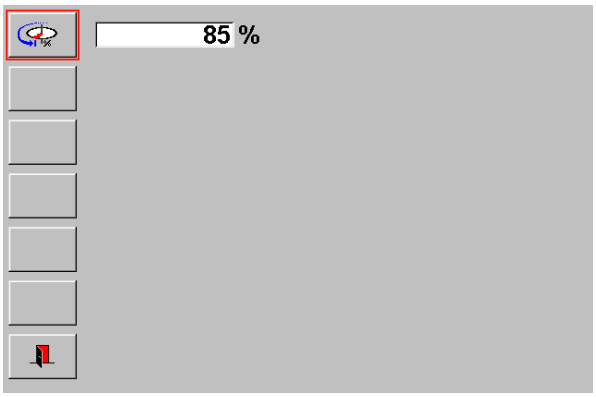
Value
Enter desired dosage interval for energy or time dosage with keypad or THB.
Unit / mode
Select the appropriate unit with up down cursors (cyclical mode):

Unit	Mode
s, min, hr	Time dosage
Ws, Wh, kWh	Energy dosage

Class 3.5 % **Class**

Select with THB or up / down cursor or enter directly with keypad the accuracy class of measuring system in percentage (%) as indicated on meter or specifications. This value will be used for good / bad evaluation during the test run.

9.1.6 Mark positioning setup



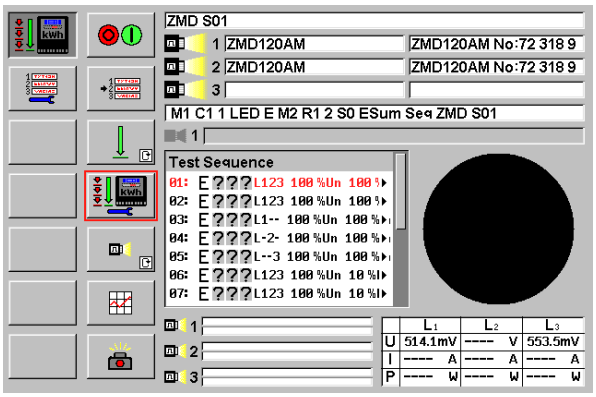
Mark positioning setup menu
Definition of stop position of disk mark in percentage of a full revolution.



Select value with up / down cursor or enter directly with keypad in percentage.

Exit, back to calling menu

9.2 Run automatic or step by step test



Test run menu - test prepared

FB's for preparation of test run:

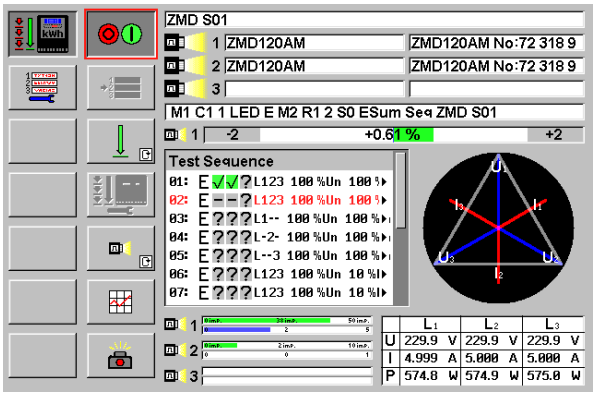
 Select start or next test step

 Test mode automatic or step by step

 Test sequence and meters setup

Following display fields show the actual meter and sequence definition:

- Test sequence file name (ZMD S01)
- Meter type (ZMD120AM) and meter (ZMD120AM No:72 318 9) file name for inputs 1 to 3, where meters are defined.
- Comment to test setup (abbreviated form)
- Window with test sequence steps



Test run menu - automatic test running

FB's for execution of test run:

 Start / Stop test run

 Select error Indication for input 1, 2 or 3

 View test step results

 Storage of test results

Following display fields and indications are active during test run:

- Error tolerance band above test step window
- Actual running step (red) with status indication for inputs 1 to 3 in test step window
- Two bar graphs for each input, showing the status of actual measurement and repetitions
- Load point status with vector diagram and table for voltage (U), current (I) and power (P) for phases L1, L2, L3 on the right side



Graphical error indication with tolerance band

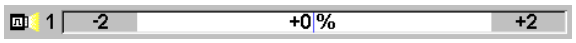
Selection of input



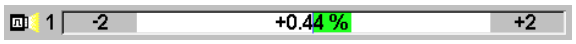
Change between indication for input 1, 2, 3 (cyclical mode)

The result of the last finished test run of the selected input is shown. The error is indicated numerical and graphically with a bar graph starting at the blue zero line, indicated in relation to the white tolerance band. Lower and upper limits are indicated in percentage.

Different error indications



No bar graph, new step, no result yet



Green bar graph, error within tolerance



Red bar graph, error out of tolerance

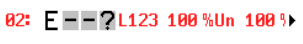


The Indication is inactive, when the test run is stopped (Start / Stop FB is out).



Indications in Test Sequence window

Actual test step



Test step position and step name are red marked

Test step type

E Type Error

\# Type Energy (register test)

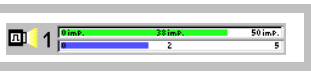
Test step status for measuring places 1, 2, 3

? Not yet executed, no result or input not defined

\- Step running

√ Step finished, error within tolerance

E Step finished, error out of tolerance

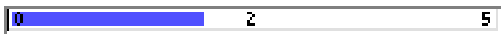


Status of actual running test step

For each measuring input there is an individual status indication for the actual running test step.



Status of actual measurement
The actual counted impulses (38 imp.) of the running measurement and a green bar graph in relation to the programmed test duration t (50 imp.) are indicated.
The test duration can also be indicated in seconds (s). At test steps of type energy no numerical values are indicated.



Status of repetitions
The actual status of the executed repetitions of the measurement (2) and a blue bar graph in relation to the programmed number of repetitions (5) are indicated.

Start / Stop test run

Start of a test run is only possible, if a test sequence with at least one test step is defined and if at least one meter is defined.

Test stopped

Source status

	Voltages and currents are switched off

Status of functions in both test modes

	Test sequence and meters setup can be changed
	Start or next test step can be defined

Test running

Source status

	Voltages or voltages and currents are switched on
	Currents are switched off / on between test steps

Note: The voltages are always on as long as the start / stop FB is depressed.

Status of functions in test mode automatic

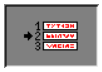
	Test sequence and meters setup is not accessible
	Start or next step is not accessible as long as test run is active

Status of functions in test mode step by step

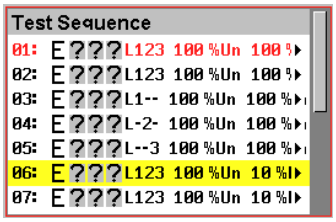
	Test sequence and meters setup is not accessible
	Start or next step is not accessible as long as test step is active
	Start or next step is active between steps

Select start or next test step

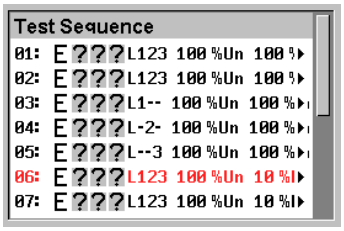
The function is used to select the start test step in both test modes.
In test mode step by step the function is also used to define the next step.



Activate function
A red frame surrounds the test step window and a yellow selection line is shown on position 1



Select new position
Move yellow line with THB to desired start or next step position.



Terminate selection
Push on THB at selected position. The selected position is marked red.



Start step
The function is terminated



Next step
The selected test step is automatically started and the function is locked as long as the test step is running.

Test mode



Automatic test run
The test runs full automatic for error measurement test steps from selected start test step until the last test step in the sequence and then stops.
If there are energy measurement test steps within the sequence, the sequence stops and waits for user input of start or end readings. When the input is finished the sequence runs automatic again.



Step by step test run
The selected test step runs. When the step is finished the current is switched off, but the voltage remains on. The next step is selected. The user must manually select and activate the next step with the select start or next step function.



Call **test sequence and meters setup** menu [9.2.1]

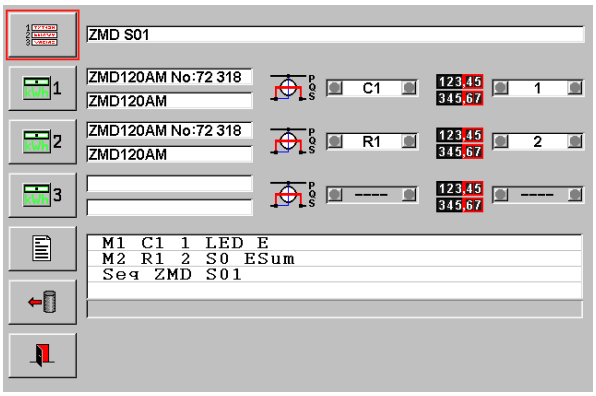


Call **view test step results** menu [9.2.2]



Call **storage of test results** menu [10]

9.2.1 Test sequence and meters setup



Test sequence and meters setup menu
The file names of the actual loaded data base elements are shown at:

- Test sequence
- Meter and meter type of input 1
- Meter and meter type of input 2
- Meter and meter type of input 3

To setup meters and comment at once call:

- Load ADS of customer

Make individual definitions by calling the FB's:

- Load / edit test sequence and meters individual

Enter or modify directly with THB and keypad or external keyboard:

- Comment to setup
- Exit, back to calling menu

Indications / settings

1 2 3	**Load / edit meters** for measuring inputs 1, 2, 3

The three measuring inputs can be assigned to three impulse outputs, defined with a meter constant, and be assigned to three counters.

The file selection menu [6.1] is called with the object file directory:

Meter Selections

There are two possibilities to assign the meters to the inputs:

Load meter file from data base
Three different meters or the same meter one, two or three times can be loaded with different impulse outputs, measuring systems and counters selected.
Restriction: The meters must have the same Imax and network type. If this is not the case the entries are shown red and the exit is blocked. See also error handling [9.6].

Edit actual meter dataset
Select sub menus and activate edit actual object until the meter menu is displayed. Enter directly the data for meter and meter type. It is not necessary to fill out all the fields. See also descriptions of edit and dataset in chapter [6].



Load / edit test sequence

The file selection menu [6.1] is called with the object file directory:
Check Sequence Selections

There are two possibilities to define the actual test sequence:



Load test sequence file from data base
Test sequences previously defined by the test sequence editor and stored in the data base can be loaded.



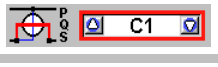
Edit actual test sequence
Select sub menus and activate edit actual object until the sequence editor is displayed [9.1.1]. Define test steps directly.



Load administrative dataset (ADS)

The file selection menu [6.1] is called with the object file directory: **Select Admin Dataset**

If the ADS contains meters, they are automatically loaded at positions 1 to 3. By loading predefined ADS of customers the measurement setup can be done in a fast and comfortable way. The link to the needed test sequence and the settings for impulse output and meter selection can be made in the ADS comment, which is also loaded.



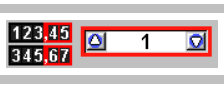
Select impulse output to test

Select one of the up to 8 meter constants, based on the two constant types and up to four measuring systems (x = 1,2,3,4), defined in the meter type linked to the loaded meter. This selection is necessary if the copy form meter function is activated in the test sequence. In this case the meter constant for the measurement is taken from the meter type of the loaded meter regarding the selection.

---- **No constant defined**
The field can not be selected. This is the case if no constant or even no meter type is defined in a reduced setup.

C1 **Optical constant (Co)** of measuring system 1 defined.

R1 **Electrical constant (Ce)** of measuring system 1 defined.



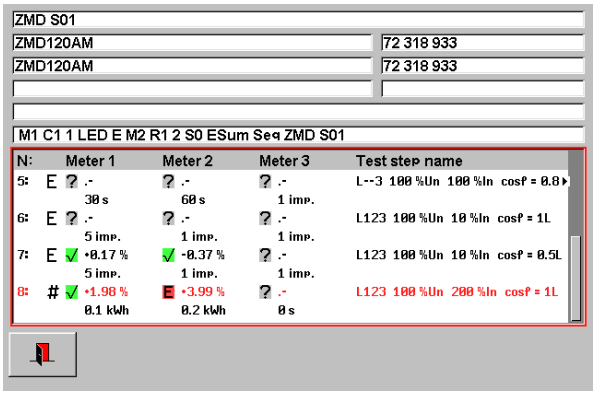
Select counter to test

Select one of the up to 4 counters, defined in the meter type linked to the loaded meter. This selection is necessary if the copy form meter function is activated in the test sequence. In this case the counter (register) type and format is taken from the meter type of the loaded meter regarding the selection.

---- **No counter defined**
The field can not be selected. This is the case if no counter or even no meter type is defined in a reduced setup.

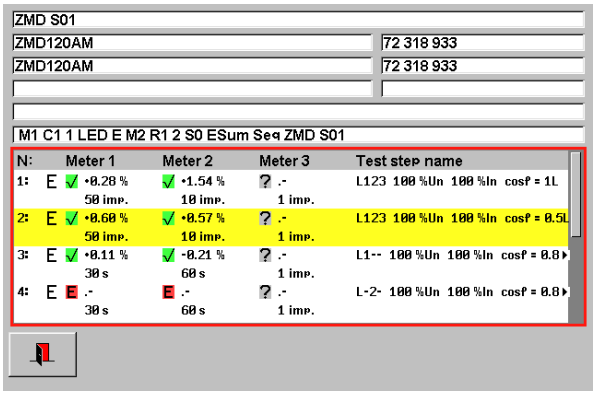
1 **Counter 1** is selected.

9.2.2 View test step results



View test step results menu
In the upper part of the display test sequence, definitions for inputs 1 to 3 with meter name and serial number are shown.
The window in the lower part shows the test step list with additional information to the test step:

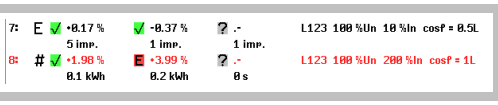
- Error measurement status and results for meters (inputs) 1 to 3 on first line of test step
- Test duration settings (imp, s, kWh) for meters (inputs) 1 to 3 on second line of test step



View test step results menu - scroll mode
If not all test steps are visible within the window, they can be scrolled.
Push THB to activate the scroll mode. Move yellow selection bar by turning the THB.
Push THB again to stop scroll mode.

Exit, back to calling menu

Indications / settings



Results and status indications in test step window

Additional to the status indications, shown in the test sequence window of the test run menu, status of measurement, error results, test duration and more details of test step name are shown here.
The status indications are shown for each meter (input) individual

Measurement status / error result

.-	Step Not yet executed or not defined at step not selected
.-	Waiting for start impulse at actual step
--.-- %	First measurement of N measurements running, no error result available yet
•1.98 %	Last measured error result of selected test step. The value is updated during test runs with several repetitions (N>1).
•0.17 %	Last measured error result of not selected, finished test step.

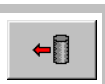
Test duration (t/n) defined for test step and input

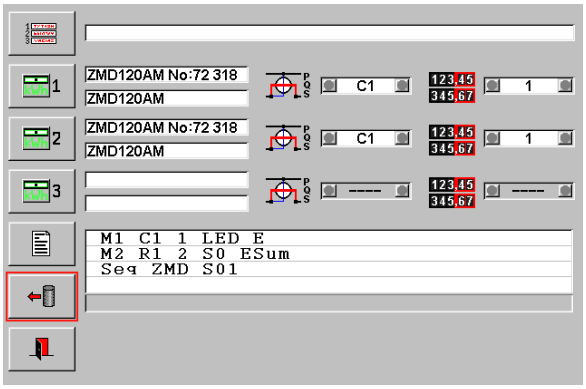
50 imp.	Test type error with test mode imp, 50 impulses tested
30 s	Test type error with test mode time, 30 s tested
0.1 kWh	Test type energy with test mode energy in kWh, 0.1 kWh dosage

9.3 Preparation of test run

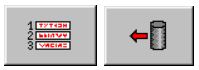
9.3.1 Work with Administrative Data Sets (ADS)

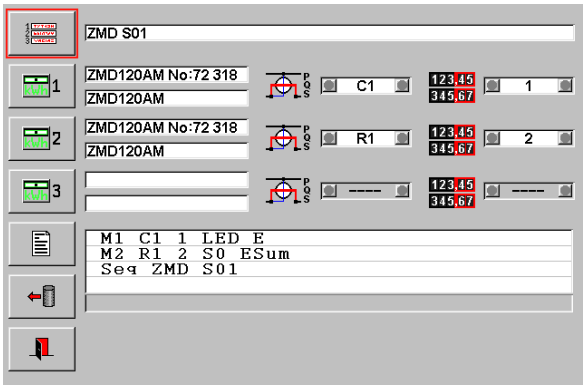
The example is shown for a completely defined ADS with instructions for selection of impulse outputs and counters for test with a test sequence, which uses the copy from meter function.

1		Load administrative dataset of customer from data base



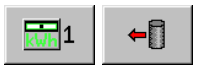
The meters defined in the ADS are automatically loaded. The example shows a configuration with the same meter defined at measurement input 1 and 2.
Two impulse outputs and two counters of the same meter shall be tested at the same time.
The necessary configurations of impulse outputs and counters can be found in the ADS comment.
The test sequence, which shall be used for this test is also noted in the ADS comment.

2		Select impulse output C1 at measuring input M1 (LED impulse output)
3		Select counter 1 at measuring input M1 (E energy counter)
4		Select impulse output R1 at measuring input M2 (S0 impulse output)
5		Select counter 2 at measuring input M2 (Esum total energy counter)
6		Load test sequence file ZMD S01 from data base



The configuration is made as described in the comment. The test run can be started.

9.3.2 Work with individual meters and test sequences of data base

1		Load meter file for input 1 from data base

The meter and the meter type object file name are indicated in the two fields. Impulse output selection and counter selection become accessible.

2		Select impulse output of meter 1 to test

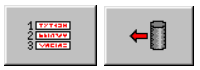
Select one of the meter constants Cx, Rx (C = Co: optical constant, R = Ce: electrical constant) of the up to four measuring systems (x = 1,2,3,4) defined in the meter type linked to the loaded meter.
For test sequences, where the copy from meter flag is set at least one meter constant (e.g. C1) must be defined to run test steps or type error.
For test sequences with fix error measurement parameters and copy from meter flag not set, the impulse output must not be selected.

3		Select counter (register) of meter 1 to test

Select one of the defined counters x of the up to four counters x = 1,2,3,4 defined in the meter type linked to the loaded meter. For test sequences, where the copy form meter flag is set at least one counter must be defined to run test steps of type energy.

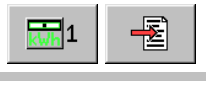
4		Repeat steps 1 to 3 for input 2 (optional)

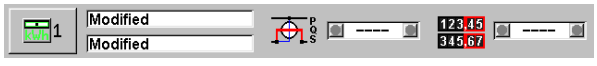
5		Repeat steps 1 to 3 for input 3 (optional)

6		Load test sequence file from data base

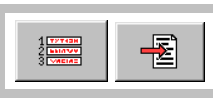
9.3.3 Work with direct entries for meter and test sequence

The example shows a minimum directly entered meter and test sequence definition to enable a test run with input 1.

1		Input minimum meter settings for input 1



Select sub menus and activate edit actual object until the meter menu is displayed. Make at least one input (e.g. serial number). Go back with several exit FB's until setup menu is displayed again with entries Modified at meter and meter type file name.

2		Define a test sequence with one test step directly

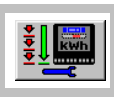
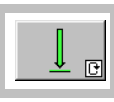
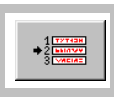


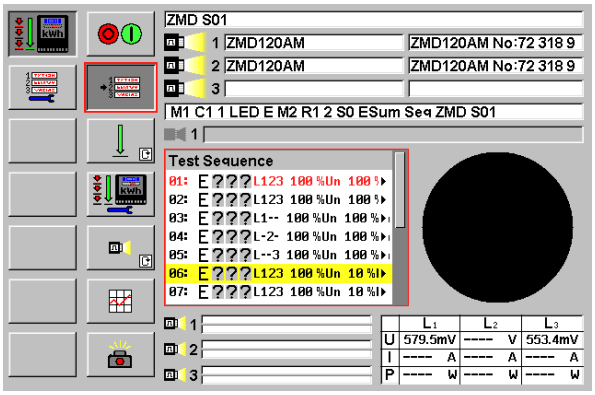
Select sub menus and activate edit actual object until the test sequence editor is displayed. Insert a new step and define fix load point settings for voltage, current and phase angle and fix parameters for error or energy measurement of input 1. The copy from meter flag must be empty.
Go back with several exit FB's until setup menu is displayed again with entry Modified at test sequence file name.

9.4 Test run examples

9.4.1 Automatic test run

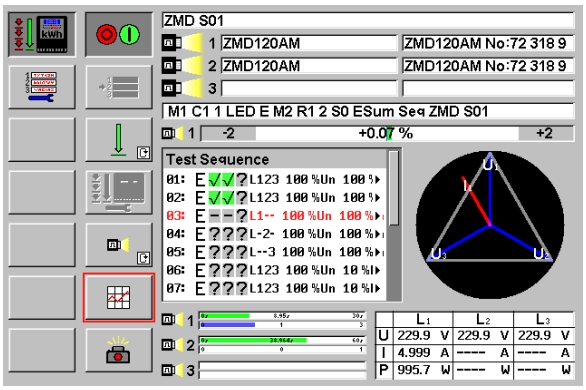
The test is running full automatic if the test sequence contains only test steps of type error.
The test is running half automatic, if test steps of type energy are included, see [9.4.3].

1		Prepare test run, see [9.3]
2		Select test mode automatic
3		Select start test step (default position 01)

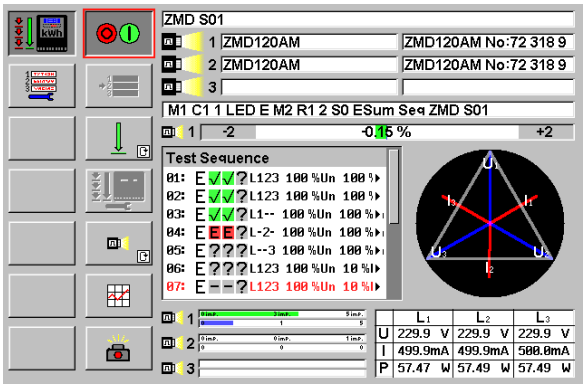


Select any start step with the yellow selection line. The default start step is 01.
The selected start step becomes red.
The sequence will run automatically form start step until the last step in the sequence

4 Start test run



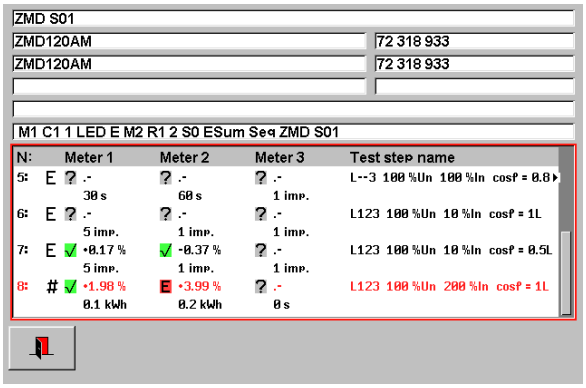
The example shows a running test sequence with total 8 steps. Steps 01 and 02 are already finished and the results are OK. Step 03 is actual running. It is a single phase measurement with only current of phase 1 switched on (L1--).



The example shows the same test sequence at a later state with step 07 running.
Steps 01 to 03 are already finished with results OK. At step 04 the test sequence was interrupted, therefore the errors are shown bad. Step 07 was chosen as new start step and the measurement was restarted at step 07.

The test run stops automatic after last test step

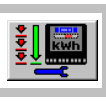
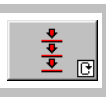
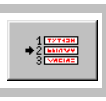
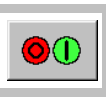
5 Track test step results with result view function

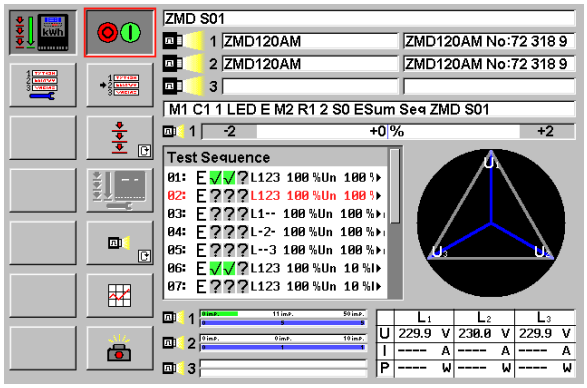


More detailed information to the status and settings of the test steps can be seen in the view test steps results menu.
The errors of the last measurement are shown for the different steps and meters 1 to 3 (input 1 to 3).

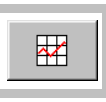
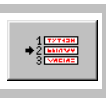
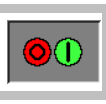
6 Call **storage of results** menu to save and / or print results [10]

9.4.2 Step by step test run

1		Prepare test run, see [9.3]
2		Select test mode step by step
3		Select start test step (default position 01)
4		Start test run



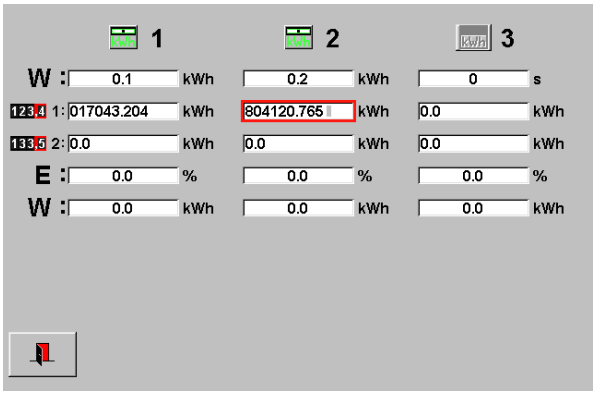
The example shows a step by step test run with point 06 and 01 finished. The step 02 is automatically selected as next step. The user can start this step by pushing with THB on select next step two times or he can push the THB once at select next step, than select any other step by turning the THB and push THB again to select and directly start the new step.
Note: Between the steps the voltages remain always on.

5		Track test step results with result view function
6		Define next step and restart
7		Stop test run manually
8		Call **storage of results** menu to save and / or print results [10]

9.4.3 Test run with test steps of type energy

An automatic test run doesn't run full automatic. It will be stopped at each test step of type energy to enter start and end readings.

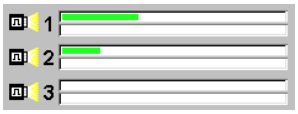
1 Enter start readings for defined counters



At the begin of a energy type test step the voltage is switched on and the system waits for the input of start readings by the user.
In this example two counters are defined for the measuring inputs 1 and 2. Input 3 is not defined and therefore grayed out. The counter format (digits before / after decimal point) is taken from the meter type.
Select entry fields with THB and enter start readings of the defined counters.
The two counters have different test durations defined (0.1 kWh, 0.2 kWh).
The smallest value (0.1 kWh) will be taken as reference

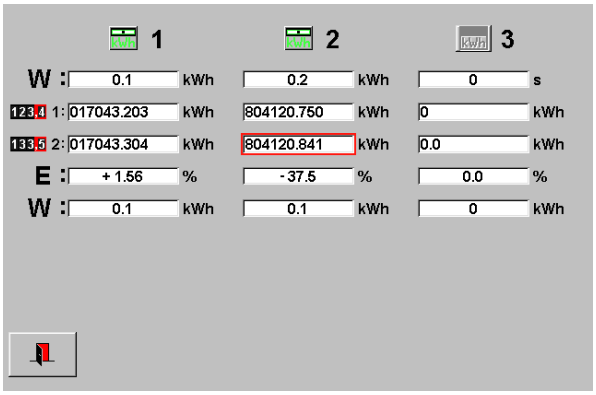


Select exit to terminate the input and to start the energy dosage.



Status indications during test
The green bar graph shows the already dosed amount of the defined dosage energy. The bar graph of input 2 is shown with half length, because the programmed value (0.2 kWh) is double the value of input 1 (0.1 kWh).
The test stops, when the bar graph at input 1 reaches the end.

2 Enter end readings for defined counters



After automatic stop the system waits for user inputs of the end readings.
Select entry fields with THB and enter end readings of the defined counters. The counter error is calculated and displayed.
The last line shows the energy, which was really dosed and taken as reference for the error calculation.

9.4.4 Functions to change / interrupt / restart the test run



Change test mode within test run

The test mode can be changed at any time within an active test run.
As soon as the actual test step is finished, the new test mode is used for the next step.
E.g. changing form automatic to step by step test mode can be used for a well defined mean stop of an automatic test run. The test run stops, when the actual test step is finished . The voltages are not switched off. Single steps can now be tested or a new start step can be defined and the automatic test run can be restarted by changing back to automatic test mode.



Interrupt active test run

An active test run can be stopped at any time. The already measured step results remain in the temporary storage as long as no new test sequence is loaded or as long as the test step is not repeated.
Note: The source is completely switched off, currents and voltages. During test of electronic meters it may not be advisable to interrupt the test in this way.



Restart stopped test run

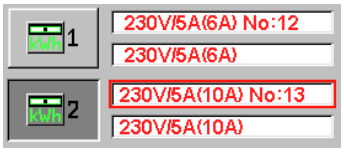
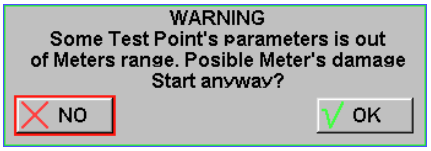
The test run will go on with the selected test mode starting at the marked test step.
If an automatic test was interrupted, optional a new start step can be selected before the start / stop button is pressed (e.g. to repeat an already finished part of a test sequence or to omit some test steps).

9.5 Useful functions available during test run

The other menu cards are not locked during the test run is active.
The following functions can be called at any time during the test run without influencing the measurement results.

Function call	Description
	View detailed test step results in storage of results print preview
	Track test step settings with Source Load point menu
	Track test step settings with reference measurement functions
	Work parallel in data base (e.g. to enter or change ADS of customer)

9.6 Error handling

Indication / effect	Error reason	Solution
 Test run start / stop is locked	No valid meter and / or test sequence is defined or communication to units is not ok.	Define missing part in meters and test sequence setup. Check communication status.
  Exit of menu is locked	Two meters with different Imax values or different network types are defined.	Test each meter individually with two separate test runs.
	Warning during test run if test step parameters are in conflict with meter parameters, e.g. if test current of test step is higher than maximum current (Imax) defined in meter type.	Select **NO** and change test step parameters or load other test sequence which works fine with the settings of the loaded meter. Select **YES** only, if you are sure that the meters connected are not damaged under this conditions.

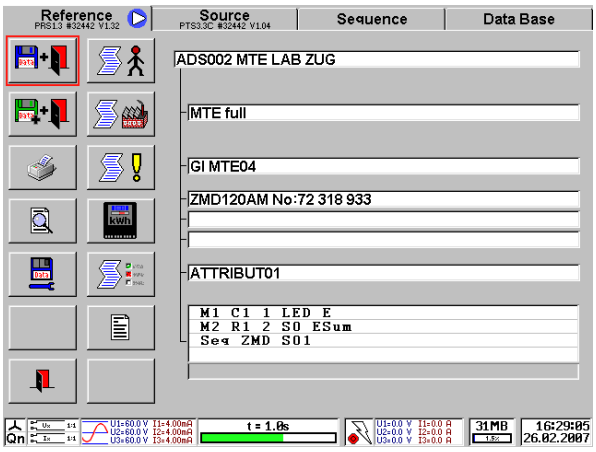
10. Storage and printout of test results

In this menu measured results, a so called Test result DataSet (TDS) can be combined with a freely configurable Administrative DataSet (ADS) to one combined result dataset. In this way the link between measured results and measuring identification (customer address, test conditions, tested meters, other checks and comment) can be made.

It is up to the user, how many ADS information he likes to define and to link to the TDS. The ADS information can be entered directly with the edit function of the data base or can be loaded full or partially from the data base.

It is recommended to define full ADS datasets for customers or measuring places with the optional software CALSOFT, installed on a PC.

As preparation for tests in the field the predefined ADS datasets or parts of it can then be uploaded from CALSOFT software into the PTS 3.1 C, either by the serial interface or by direct transfer on the compact flash card.



Storage and printout of test results menu

The combined result dataset (TDS + ADS) can be:

- saved to new file
- appended to file with last saved data set
- printed
- previewed

The right side shows the file names of the actual loaded ADS and its components:

- Administrative dataset (ADS)
- Customer dataset
- General info dataset
- Meter datasets for inputs 1 to 3
- Other checks dataset

Indications / settings

Save new or append results and go back to calling menu [10.2]

Print data by the serial interface [10.3]

Preview of results in printout format [10.1]

Call **printer and save parameters settings** menu [5.1] to define settings for:

Save mode (single / continuous) see description in chapter [10.2.1]

Printer type / baud rate / line delay see description in chapter [10.3.2]

Load / edit / reset object files

The **file selection menu** [6.1] is called and an object file directory is displayed.

Load object file
Select and load a predefined object file from the shown directory.

Edit actual object
Edit the actual dataset, which can be empty or contain the previously loaded data. All data can directly be entered. If another dataset is called in the editor menu, call the edit actual object function again, until you can enter the data directly.

Reset actual object to defaults
The dataset is reset, the file name field is cleared. No data of this type is linked with the result data.

Exit, back to calling menu
Use the exit FB to come back to the storage of results menu. Several exit steps may be necessary to come back.

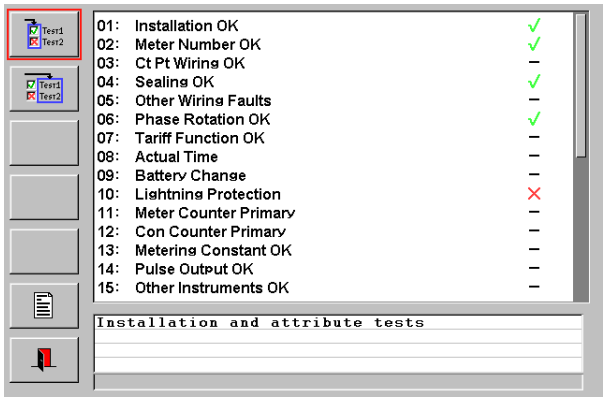
A detailed description of the listed datasets can be found in the chapters listed below.

FB	Directory	Description
	Select Customer Dataset	[6.4.2]
	Select General Info Dataset	[6.4.3]
	Meter selections	[6.5.2]
	Select Other Results Dataset	[6.4.4]

Other checks dataset

This dataset can be used to document additional test results in the form good / bad. These tests could be visual checks as listed or user defined checks, like the attribute tests: no load test and starting current test.

Call **edit actual object** at the file selection menu.



Actual other results dataset
A set of predefined (01 .. 15) and user defined checks (16 .. 25) is shown with marking:

- ✓ Good
- ✗ Bad
- – No check

The marking and user defined checks can be modified with:

- Change check boxes
- Define user result

For more details regarding this dataset see chapter [6.4.4].

	Comment

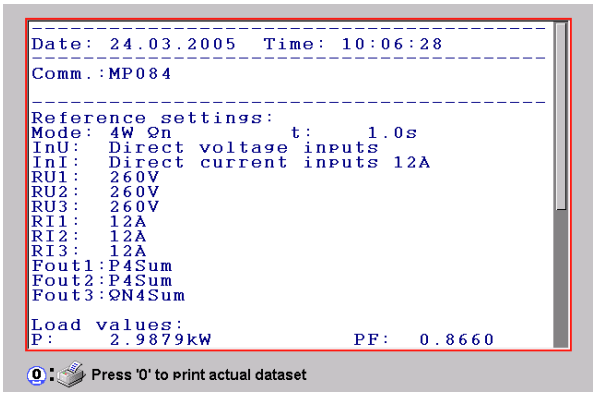
If a complete ADS dataset is loaded, the ADS comment is displayed here.
Enter or modify comment with THB and keypad or external keyboard.
This field can also be used for simple measurement documentation, if the complete ADS and the ADS parts are not used and reset to defaults.

	Exit, back to calling menu

10.1 Preview of results

The preview function can be used to view the results before saving or printing them. With this function a fast overview over the complete results data with measured results (TDS) and the linked administrative data (ADS) is possible.

During a running test sequence the function can be used to see more detailed results of the already finished test steps. The changeover between running sequence and print preview menu has no influence on the measurement results.



Preview of results menu
The combined results (TDS + ADS) are shown in the printout format. Details regarding the look of the different printout formats for TDS and ADS parts see examples in chapter [10.3.4].



Scroll up / down by turning the THB



Exit menu by push on THB



Print results from print preview menu by push on zero key

Note: If the results are transferred to CALSOFT, they will have another look, adapted to the CALSOFT user interface.

10.2 Save results

The actual combined results of measured results (TDS) and administrative data (ADS) are saved on the compact flash card.

10.2.1 Save mode configuration

	Call **printer and save parameters settings** menu [5.1] to define the **save mode**:

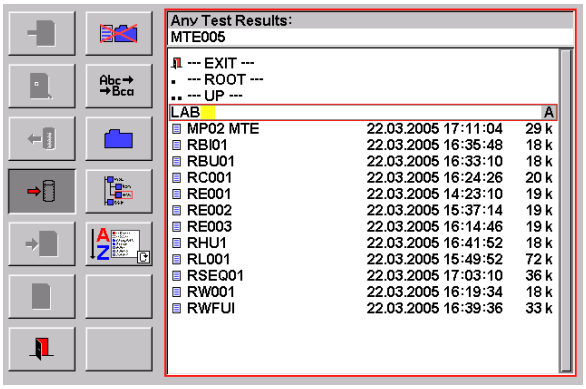
Single
One measurement results dataset (TDS) is saved

Continuous
The measurement datasets (TDS) are saved continuously at the defined time interval in s, min, h.

10.2.2 Save single measurement

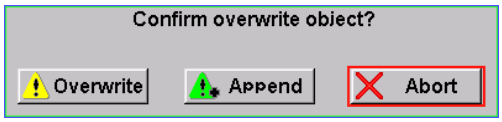
1	Run measurement
2	 Call storage of results menu
3	 Load / edit administrative data (optional)
4	 Preview results (optional)
5a	 **Call save results and exit** to create or select a new file

The **file selection menu** [6.1] is called with the directory **Any Test Results** displayed.



Save as new file

1		Call save actual object
2		Select line new in directory
3		Enter name for result file
4		Push THB to terminate save
5		Back to measurement menu



Save to existing file
Confirm overwriting file or append new results dataset to existing file.
With **Append** several measurements can be saved in the same file and be transferred to CALSOFT by readout of just one result file.

5b	 **Call append results and exit** to save directly to the last selected file.

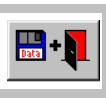
With this function several measurements can be added to the same file (e.g. all measurements of one customer).

The FB is only enabled, if a file was created/selected before and a data set saved already regarding point 5a.

10.2.3 Save continuous measurements

1		Call storage of results menu

2		Load / edit administrative data (optional)

3		Call save results and exit to define a result file

The **file selection menu** [6.1] is called with the directory **Any Test Results** displayed.

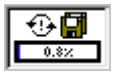
Create result file, as described under save single measurement step 5.

The continuous storage mode is automatically started, when the file selection menu is left with the exit door FB. The calling measurement menu is displayed again.

Status indications



The camera FB is shown depressed during continuous saving is active.



The compact flash status indication changes periodically to the save continuous symbol. The background of the compact flash status indication becomes periodically red during data is saved.

3	Run measurement

The measurement results are cyclically saved with the defined time interval

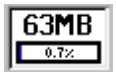
4		Select camera FB and push THB to stop continuous saving.

The data saving is stopped.

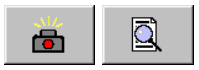
Status indications



The camera FB is shown normal again.



The save continuous symbol disappears and the normal compact flash status indication is displayed again.

5		Call storage of results menu and preview results (optional)

The last saved measurement results are shown. With the preview function only one of the saved result sets can be viewed. To see all the saved results the data must be transferred to CALSOFT.

6		Exit, back to calling measurement menu

10.3 Print data

The measured results and also data base objects can directly be printed by the serial interface RS232.

The printing format is given.

10.3.1 Printer requirements

Following printer types with listed specifications are tested and recommended by the manufacturer:

Dot matrix printer: **type DATAMEGA DPN-2335-40-V.24**

Thermo printer: **type CITIZEN PD-04**

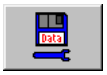
Specification

- Portable alphanumeric printer: 40 characters per line, standard ASCII character set supported
- RS232 serial interface: 8 bit, no parity, 1 stop bit, no control signals used (only RXD, TXD, GND connected), baud rate: 9600 bd

Attention! If another printer model than the recommended shall be used, we strongly recommend testing the printer before buying.

If another printout format is needed or another printer type should be supported, the data must be transferred to the PC and printed from PC with software CALSOFT or a customer specific solution based on export of the data to Excel.

10.3.2 Printer configuration



Call **printer and save parameters settings** menu [5.1] to define printer settings:



Type: Epson (DATAMEGA DPN-2335-40-V.24) / Citizen (PD-04) / No printer



Baud rate: 4800 / 9600 / 19200 / 38400 / 57600 / 115200 bd (default: 9600)



Line delay: 200ms / 500ms / 1000ms / 2000ms or OFF.

10.3.3 Call of printout

Two ways to print:



Print by activating the printer symbol at storage of results menu

The actual combined results (TDS + ADS), as shown in the storage and printout of test results menu, are printed.



The printer symbol is shown depressed as long as printing is active.



Print by operating the zero key at print preview menu

The actual combined results (TDS + ADS) or viewed object files from data base are printed as shown in the print preview window.

10.3.4 Layout of printout

The printout is divided in several parts separated with dashed lines. The parts are printed depending on the defined administrative data and the type of results.
The printout looks exactly like shown at the print preview function.

Header

```
----------------------------------------
Date: 10.07.2009  Time: 11:06:21
```

Direct printout
Date and time of measurement are printed.

```
----------------------------------------
Date: 10.07.2009  Time: 11:07:25
FName:E003
```

Printout of result file
Date and time of measurement and the result file name are printed.

```
----------------------------------------
Date: 02.07.2009  Time: 16:31:22
FName:E001
Res.: 1/3
```

Printout of result file with n datasets
Additional to filename, date and time the shown result 1 of n saved datasets (1/n) is indicated.

Administrative data (optional)

```
----------------------------------------
Customer:
Adr.: MTE AG
```

Customer data
Customer address and information is printed in the form as defined (e.g. only company name)
For different parts of administrative data see separate table

```
----------------------------------------
Comm.: M1 C1 1 LED E
       M2 R1 2 S0 ESum
       Seq ZMD S01
```

Comment
Any comment on four lines

Test result data

```
----------------------------------------
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 1A/10A
RU1:  250V
RI1:  12A
Fout1:PSum
```

Reference settings
Actual settings of the reference meter during the measurement:

- Mode: connection mode (4W) and reactive mode (Qn) and time base (t)
- Inputs used (InU, InI)
- Activated internal ranges per phase for voltage (RU1) and current (RI1)
- Definition of the impulse output (Fout1)

```
Load values:
U:    229.97 V          Phi:  29.97 Deg
I:    10.003 A
P:    1.9931kW          PF:   0.8664
Q:    1.1488kvar
S:    2.3003kVA         f:    50.000 Hz
```

Load values

- Voltage (U)
- Current (I)
- Phase angle I to U (Phi)
- Active power (P)
- Reactive power (Q)
- Apparent power (S)
- Power factor (PF)
- Frequency (f)

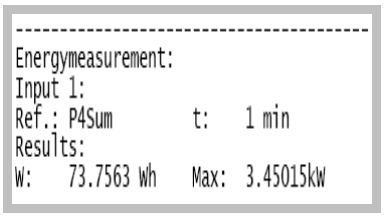
```
----------------------------------------
Errormeasurement:
Input 1:
Ref.:  P1           t/n:   3 imp
C/R:   480i/kWh     N:     5
EMin:  -2.000 %     EMax:  +2.000 %
Results:
E:     +0.214 %
Em(5): +0.207 %     Es(5): +0.009 %
```

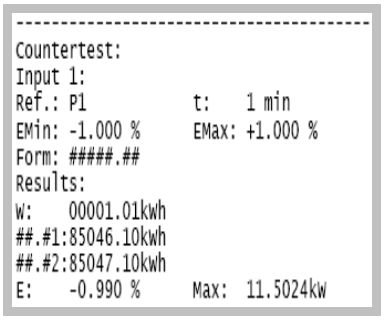
Error measurement

- Energy mode (Ref.)
- Test duration (t/n)
- Meter constant (C/R)
- Number of repetitions (N)
- Tolerance band (Emin, Emax)

and the results:

- Last measured error (E)
- Mean value of error (Em(5))
- Standard deviation (Es(5))





Energy measurement

- Energy mode (Ref.)
- Maximum period (t)

and the results:

- Measured energy (W)
- Maximum power (Max)

for each configured input are printed.

Counter test (register test)

- Energy mode (Ref.)
- Maximum period (t)
- Tolerance band (EMin, EMax)

and the results:

- Tested energy (W)
- Start counter reading (##.#1)
- End counter reading (##.#2)
- Counter error (E)
- Maximum power (Max)

are printed for each configured input.

For other results see table with examples of different types of results.

Different parts of administrative data

Size and content of printout can vary depending on loaded or entered data.

Customer data

```
----------------------------------------
Customer:
Adr.: MTE Meter Test Equipment AG
      Dammstrasse 16
      P.O. box 4544
      6304 Zug
TelNo:+41-41 724 24 48
eMail:info@mte.ch
Comm.:Worldwide distributor  of EMH / ED
```

General info data

```
----------------------------------------
Test conditions:
Installation:
Adr.: MTE Laboratory

Tester information:
Name: C. Miller
Pos.: Inspector
No.:  MTE02

Temp:  23.8 degC
ConPwr:MIB
EnrSup:WWZ
NetOp.:ATEL

Test service buyer:
Adr.: EMH Energie-Messtechnik GmbH
      Vor dem Hassel 2
      21438 Brackel Germany
TelNo:+49-4185 5857 0
eMail:info@emh.de
Comm.:Manufacturer of EMH/MTE equipment

Reference Meter:
Type: PRS 400.3
SerNo:26528
tWarm:15 min     TRACEABLE

Power Source:
Type: PPS 400.3
SerNo:26529
tWarm:0 min

Other Testequipment 1:
Type: TEMP  FLUKE
SerNo:8342
tWarm:5 min      TRACEABLE
```

Meter data

```
----------------------------------------
Meter #1:
Manuf:LG
Type: ZMD120AMtr53
Prin.:ELECTRONICAL
U:    230V       I: 5(80)A
f:    50Hz       NT:50
MSys1:P   2%     Co:10000   Ce:200
Cntr1:P+  T:2    ##:6.3kwh     E
Cntr2:P+  T:1    ##:6.3kwh     ESum
Cntr3:P-  T:2    ##:6.3kwh     E
Cntr4:P-  T:1    ##:6.3kwh     ESum
AppNo:APR012
Norm :IEC 61036
SerNo:72 318 933
OwnNo:MTE08
Currenttransformer (CT1):
N:    1A : 1A
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Currenttransformer (CT2):
N:    1A : 1A
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Currenttransformer (CT3):
N:    1A : 1A
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Voltagetransformer (PT1):
N:    1V : 1V
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Voltagetransformer (PT2):
N:    1V : 1V
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Voltagetransformer (PT3):
N:    1V : 1V
E:    0.0%       Sn:0.0VA
CDate:01.01.2000         MYear:2000
Cntrs:T1:0.00000 0.00000 0.00000 0.00000
      T2:0.00000 ------- 0.00000 -------
Comm.:Checked 2003
```

Other checks data

```
----------------------------------------
Other test results:
Installation:          OK
MeterNoOK:             OK
CtPtWiring:            ---
Sealing:               NOT OK
OtherWiringFaults:     ---
PhaseRotation:         ---
TariffFunction:        ---
ActualTime:            ---
BatteryChange:         ---
LightningProtection:   ---
MeterCounterPrimary:   ---
ConCounterPrimary:     ---
MeteringConstantOK:    ---
PulseOutput:           ---
OtherInstruments:      NOT OK
Starting Current:      OK
```

Comment

```
----------------------------------------
Comm.: M1 C1 1 LED E
       M2 R1 2 S0 ESum
       Seq ZMD S01
```

Examples of different types of results
Size and content can vary depending on inputs configured during test.

Error measurement

```
----------------------------------------
Errormeasurement:
Input 1:
Ref.:  P1           t/n:   3 imp
C/R:   480i/kWh     N:     5
EMin:  -2.000 %     EMax:  +2.000 %
Results:
E:     +0.214 %
Em(5): +0.207 %     Es(5): +0.009 %
```

Energy measurement

```
----------------------------------------
Energymeasurement:
Input 1:
Ref.: P4Sum         t:    1 min
Results:
W:    73.7563 Wh    Max:  3.45015kW
```

Counter test (register test)

```
----------------------------------------
Countertest:
Input 1:
Ref.: P1            t:    1 min
EMin: -1.000 %      EMax: +1.000 %
Form: #####.##
Results:
w:    00001.01kwh
##.#1:85046.10kwh
##.#2:85047.10kwh
E:    -0.990 %      Max:  11.5024kw
```

Burden measurement U

```
----------------------------------------
Burdenmeasurement U1:
Parameters:
Ph: L1
Un: 57.7400 V     l:   100.000 m
SN: 5.00000 VA    A:   2.50000 mm^2
RF: 200.000mOhm

Results:
U1: 52.0148 V     Rl:  914.286mOhm
I1: 30.0172mVA    SB:  1.56134 VA
G1: 542.308uS     Sb:  38.4590 %
jB1:-197.33uS     Sn:  1.92194 VA
Y1: 577.090uS     Sns: 1.92295 VA
                  cosB:0.93973
```

Burden measurement I

```
----------------------------------------
Burdenmeasurement I1:
Parameters:
Ph: L1
In: 5.00000 V     l:   40.0000 m
SN: 10.0000 VA    A:   6.00000 mm^2
Results:
U1: 247.195mV     Rl:  119.048mOhm
I1: 2.99915 VA    SB:  741.377mVA
R1: 72.7532mOhm   Sb:  50.3674 %
jX1:37.9638mOhm   Sn:  2.06054 VA
Z1: 82.4218mOhm   Sns: 5.03674 VA
                  cosB:0.88269
```

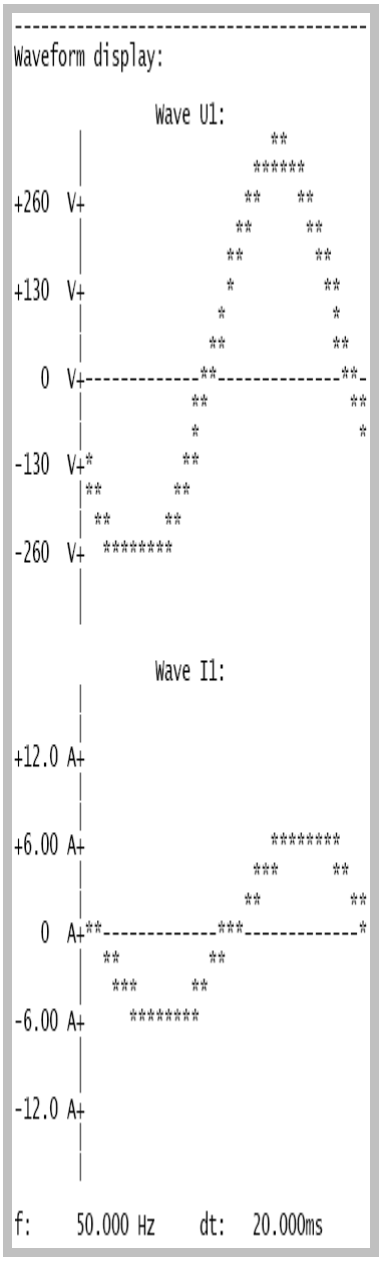
Harmonics

```
----------------------------------------
Harmonicmeasurement:
U1:   231.19 V
k:    9.9761 %
f:    50.000 Hz

            Spectrum U1:
 100%- #
  50%- #
  20%- #
  10%- #   #
   5%- #   #
   2%- #   #
   1%- #   #
 0.5%- #   #
 0.2%- #   #
 0.1%- #   #
0.05%- #   # #   #     #     # #
0.02%- #   # #   # #   # #   # #   # #
0.01%- #   ###  ## #   # #   # #   # #
       1^^^5^^^^1^^^^1^^^^2^^^^2^^^^3^
                 0    5    0    5    0

har1:  100.00 %  =  230.05 V
har5:  10.024 %  =  23.061 V
har6:  0.0139 %  =  31.982mV
har7:  0.0975 %  =  224.17mV
har10: 0.0106 %  =  24.309mV
har11: 0.0797 %  =  183.28mV
```

Wave form



Sequence results

```
----------------------------------------
Auto Test Results:

           *** No: 01 ***
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 120A
RU1:  250V
RI1:  120A
Fout1:P1

Load values:
U:    229.96 V          Phi: 359.99 Deg
I:    19.991 A
P:    4.5969kW          PF:  1.0000
Q:    -1.368 var
S:    4.5970kVA         f:   50.000 Hz

Test Type: Error:
LP:   L1-- 230V 20A phi=0deg
t/n:   15s        ------     ------
Stat:  OK         ------     ------
Err:   +0.05 %    ------     ------
Mid:   +0.05 %    ------     ------
Std:   +0.00 %    ------     ------

           *** No: 02 ***
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 120A
RU1:  250V
RI1:  120A
Fout1:P1

Load values:
U:    230.05 V          Phi:  60.14 Deg
I:    19.994 A
P:    2.3015kW          PF:  0.5004
Q:    3.9844kvar
S:    4.5997kVA         f:   50.000 Hz

Test Type: Error:
LP:   L1-- 230V 20A phi=60deg
t/n:   15s        ------     ------
Stat:  OK         ------     ------
Err:   +0.01 %    ------     ------
Mid:   +0.01 %    ------     ------
Std:   +0.00 %    ------     ------
```

```
           *** No: 03 ***
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 120A
RU1:  250V
RI1:  120A
Fout1:P1

Load values:
U:    230.03 V          Phi: 359.98 Deg
I:    100.02 A
P:    23.008kW          PF:  1.0000
Q:    -14.68 var
S:    23.008kVA         f:   50.000 Hz

Test Type: Energy:
LP:   L1-- 230V 100A phi=0deg
t/n:   1kWh       ------     ------
Stat:  OK         ------     ------
W:     00001.00   ------     ------
##.#1: 00027.60   ------     ------
##.#2: 00028.60   ------     ------
Err:   +0.00 %    ------     ------
```

Example printouts

Direct printout

Error measurement with input 1, Simple comment

```
----------------------------------------
Date: 10.07.2009  Time: 11:47:27
----------------------------------------
Comm.:MP084


----------------------------------------
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 1A/10A
RU1:  250V
RI1:  12A
Fout1:P1

Load values:
U:    229.98 V          Phi:  30.00 Deg
I:    10.003 A
P:    1.9930kW          PF:  0.8663
Q:    1.1495kvar
S:    2.3005kVA         f:   50.000 Hz

----------------------------------------
Errormeasurement:
Input 1:
Ref.:  P1           t/n:   3 imp
C/R:   480i/kWh     N:     5
EMin:  -2.000 %     EMax:  +2.000 %
Results:
E:     +0.153 %
Em(5): +0.141 %     Es(5): +0.011 %
```

Result file RE001 MTE

Error measurement inputs 1, Full customer address

```
----------------------------------------
Date: 10.07.2009  Time: 11:55:07
FName:RE001
----------------------------------------
Customer:
Adr.: Meter Test Equipment AG
      Dammstrasse 16
      6304 Zug
TelNo:+41-41-724 24 48
eMail:info@mte.ch
Comm.:Worldwide distributor of
      MTE products
      Headquarter
      Switzerland

----------------------------------------
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 1A/10A
RU1:  250V
RI1:  12A
Fout1:P1

Load values:
U:    230.08 V          Phi:  29.97 Deg
I:    10.003 A
P:    1.9941kW          PF:  0.8664
Q:    1.1497kvar
S:    2.3015kVA         f:   50.000 Hz

----------------------------------------
Errormeasurement:
Input 1:
Ref.:  P1           t/n:   3 imp
C/R:   480i/kWh     N:     5
EMin:  -2.000 %     EMax:  +2.000 %
Results:
E:     +0.153 %
Em(5): +0.148 %     Es(5): +0.004 %
```

Result file RE003

Error measurement input 1, General info and comment

```
----------------------------------------
Date: 10.07.2009  Time: 11:51:55
FName:RE003
----------------------------------------
Test conditions:
Tester information:
Name: C. Miller
Pos.: Chief of Lab
No.:  MTE005

Temp:  23.6 degC
ConPwr:
EnrSup:
NetOp.:

Reference Meter:
Type: PTS3.1C
SerNo:38800
tWarm:5 min      TRACEABLE

Power Source:
Type: PTS3.1C
SerNo:38800
tWarm:5 min      TRACEABLE

----------------------------------------
Comm.:MP084


----------------------------------------
Reference settings:
Mode: 4W Qn         t:    1.0s
InU:  Direct voltage inputs
InI:  Direct current inputs 1A/10A
RU1:  250V
RI1:  12A
Fout1:P1

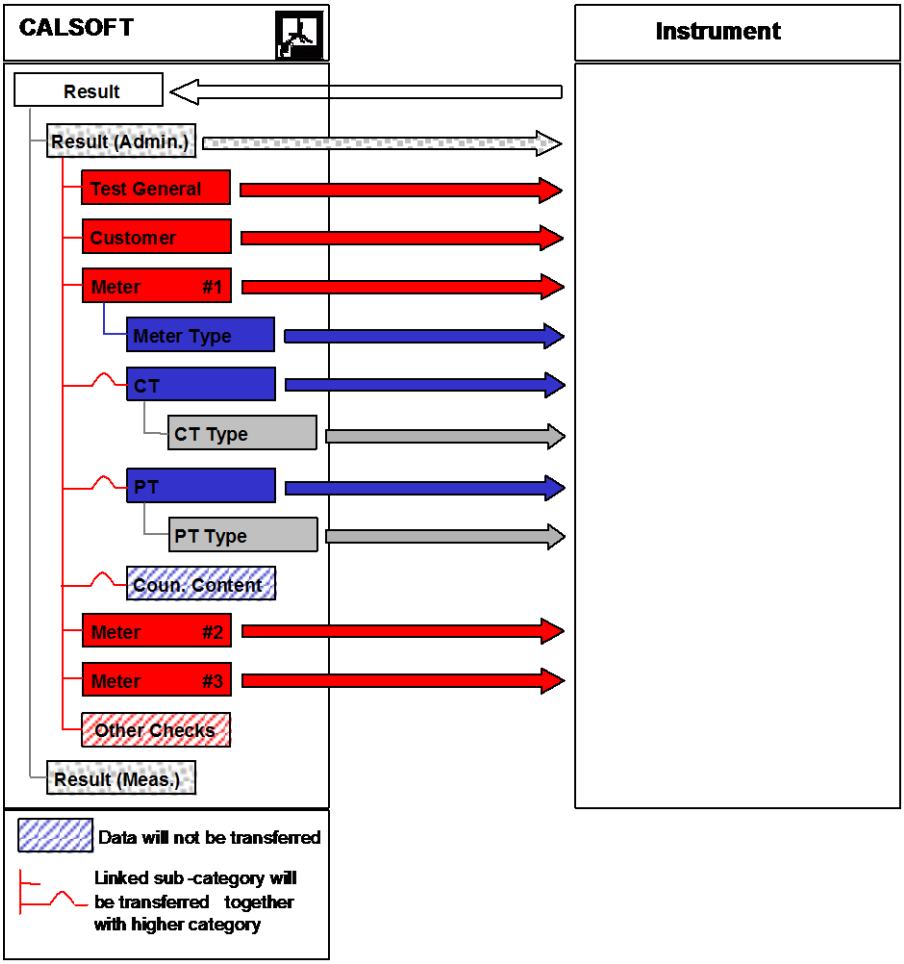
Load values:
U:    230.01 V          Phi:  29.98 Deg
I:    10.003 A
P:    1.9935kW          PF:  0.8664
Q:    1.1493kvar
S:    2.3008kVA         f:   50.000 Hz

----------------------------------------
Errormeasurement:
Input 1:
Ref.:  P1           t/n:   3 imp
C/R:   480i/kWh     N:     5
EMin:  -2.000 %     EMax:  +2.000 %
Results:
E:     +0.153 %
Em(5): +0.148 %     Es(5): +0.004 %
```

10.4 Data transfer to PC

10.4.1 Software for data readout (option)

With the optional CALSOFT software administrative data (ADS) can be uploaded to the instrument and saved data can be downloaded for further evaluation of the results and reporting of the measurements. The results are displayed on the PC in a user friendly windows environment.



10.4.2 Data transfer with compact flash (CF) card

The data can be transferred directly between instrument and a PC with software CALSOFT installed by using a flash card adapter at PC side, e.g. compact flash to USB adapter.
This is the fastest way to transfer data from and to the instrument system.

Warning!

Do not remove the CF card, if the card is actually accessed, indicated with a red background of the CF status indication. Not following this procedure may lead to corrupted files and loss of data.

The most safe procedure is to switch off the power supply before removing or inserting the CF card.

10.4.3 Data transfer by serial interface

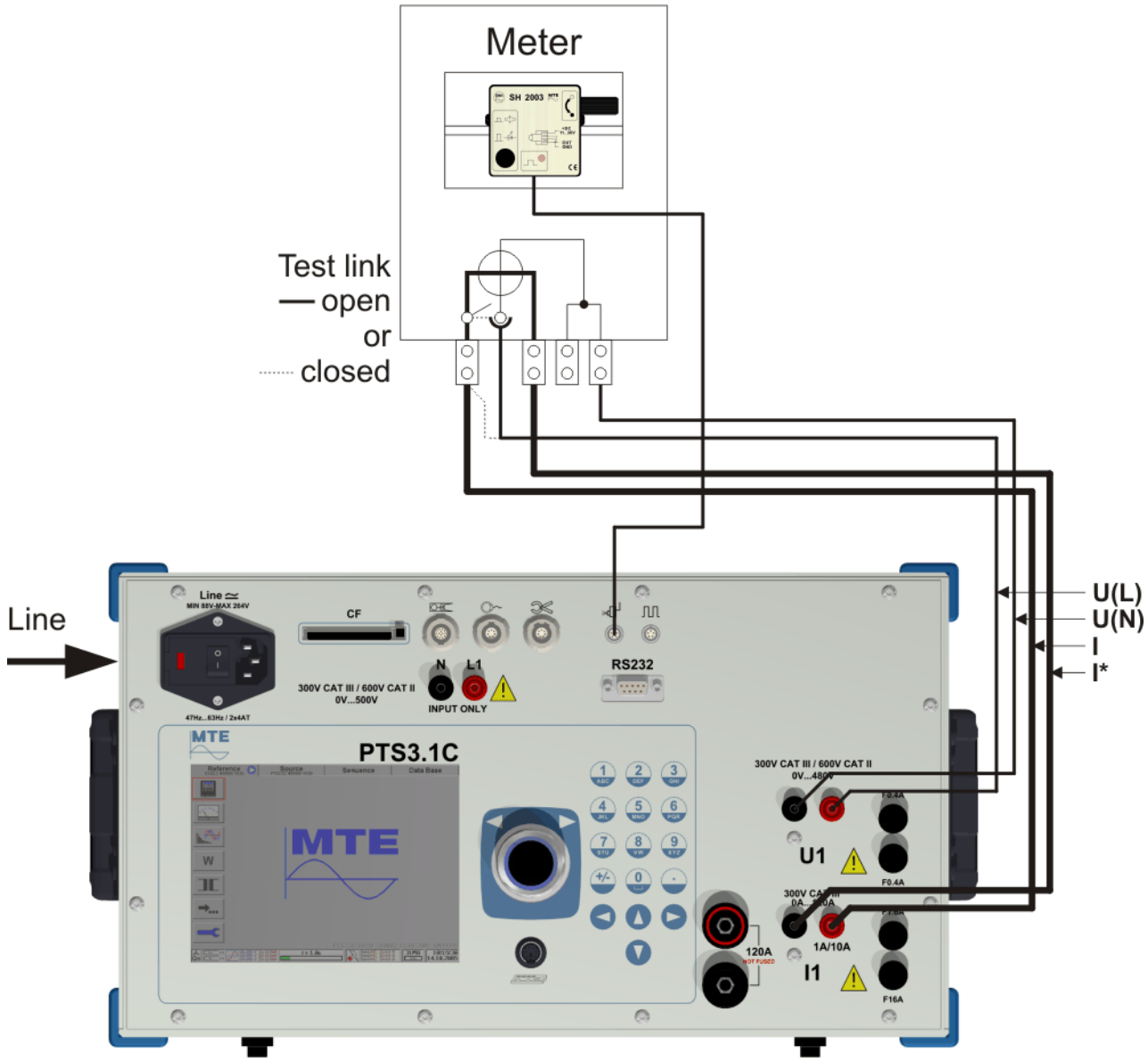
The data can also be transferred by using one of the two serial interfaces with a direct RS232 connection to a PC. With the software CALSOFT data then can be up- or downloaded.

11. Connection examples using test mode

11.1 Connection examples using test mode

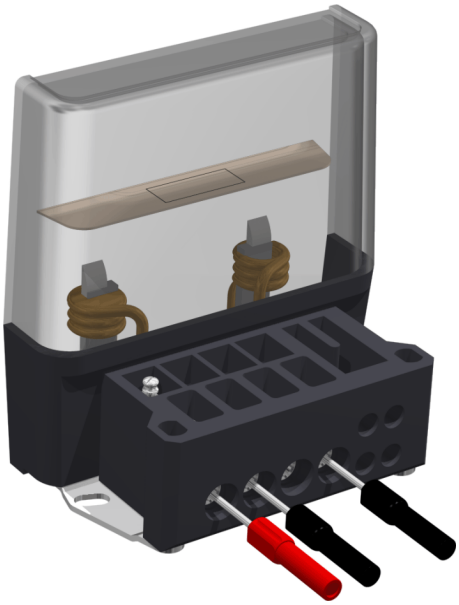
11.1.1 Testing of a direct connected meter up to 10 A

	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
		120A 12A		Test System
	≤10A:	120A 12A		Reference + Source



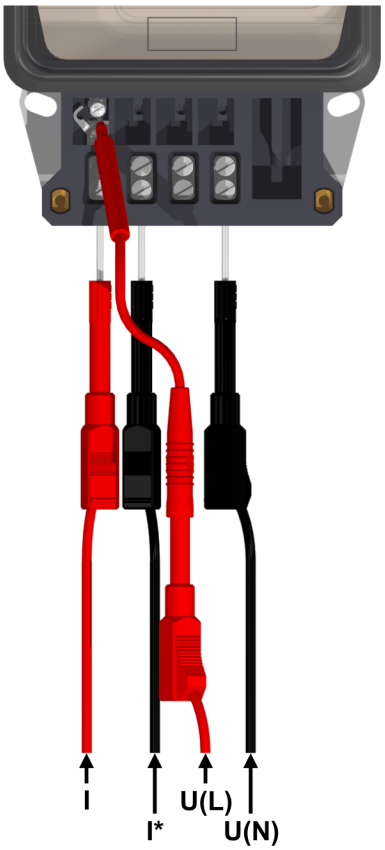
Connections to meter under test (example for IEC-type meter)

Adapter pins

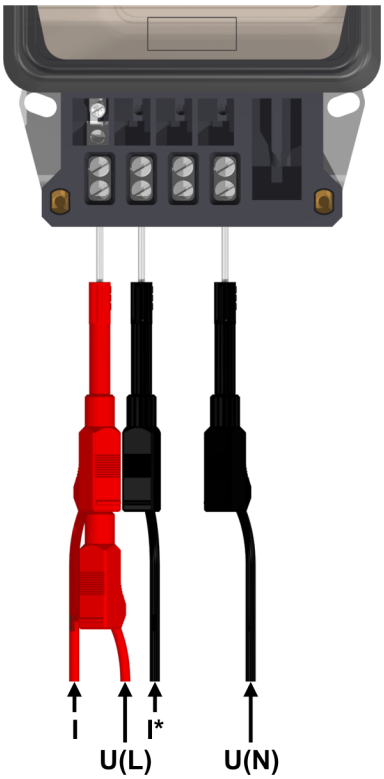


Direct connected
2-wire meter
Uninstalled on site or in laboratory
Maximum test current 10 A

Test links open



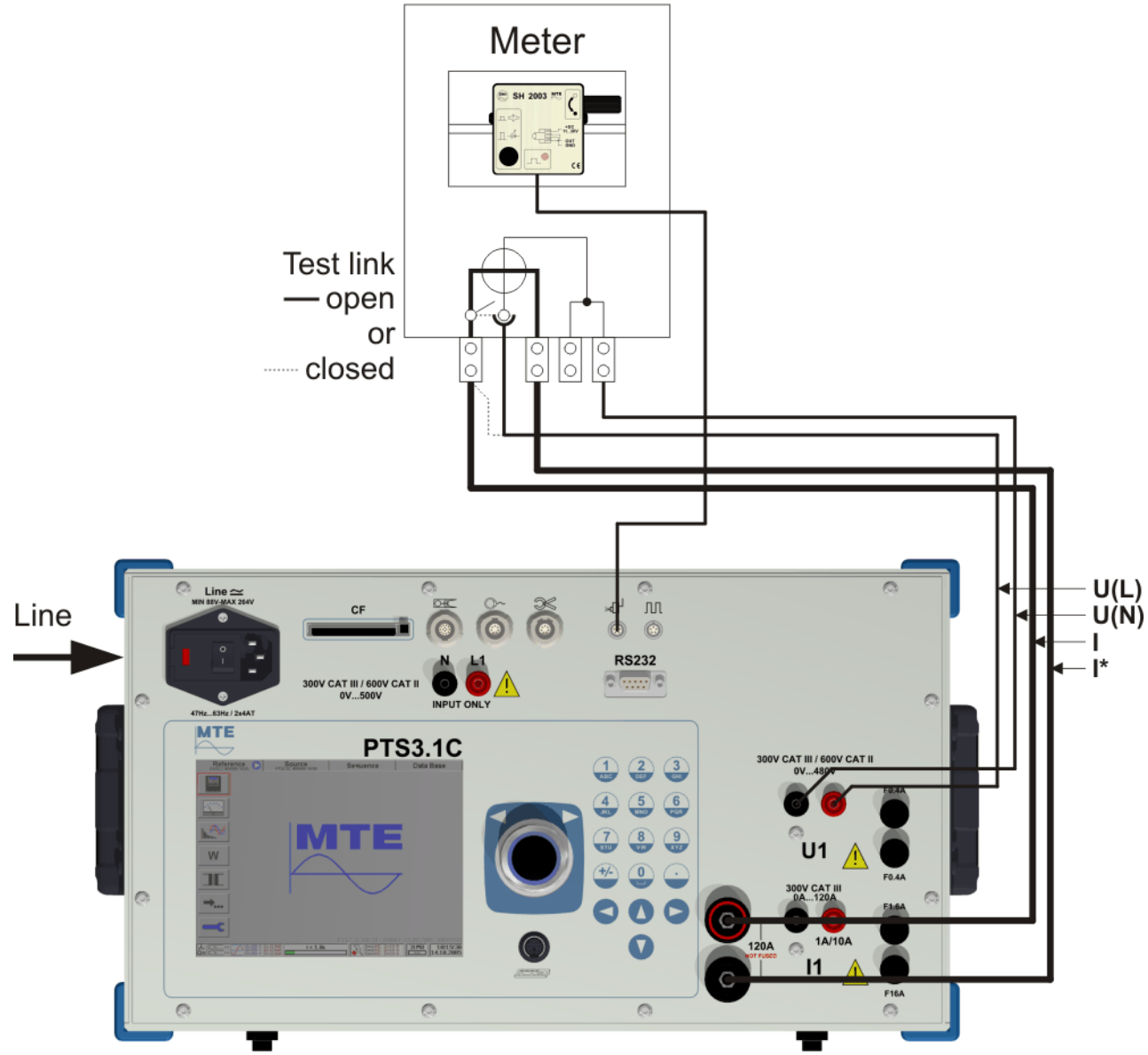
Test links closed



For other type of meters (ANSI Form S, Form A; British Standard BS etc.) consult the documentation delivered by the manufacturer and adapt the connections to the meter regarding your needs.

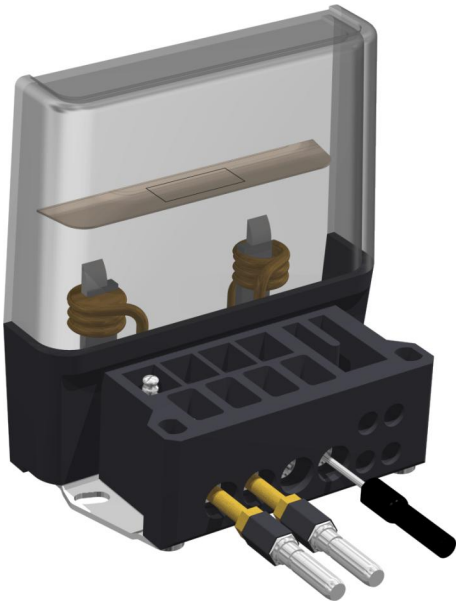
11.1.2 Testing of a direct connected meter up to 120 A

	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
		120A 12A		Test System
	≤10A: 1:1 >10A: 1:1	120A 12A		Reference + Source



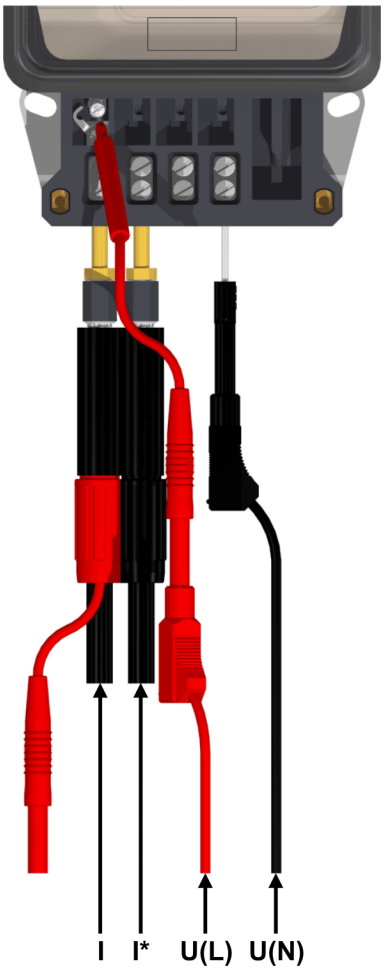
Connections to meter under test (example for IEC-type meter)

Adapter pins

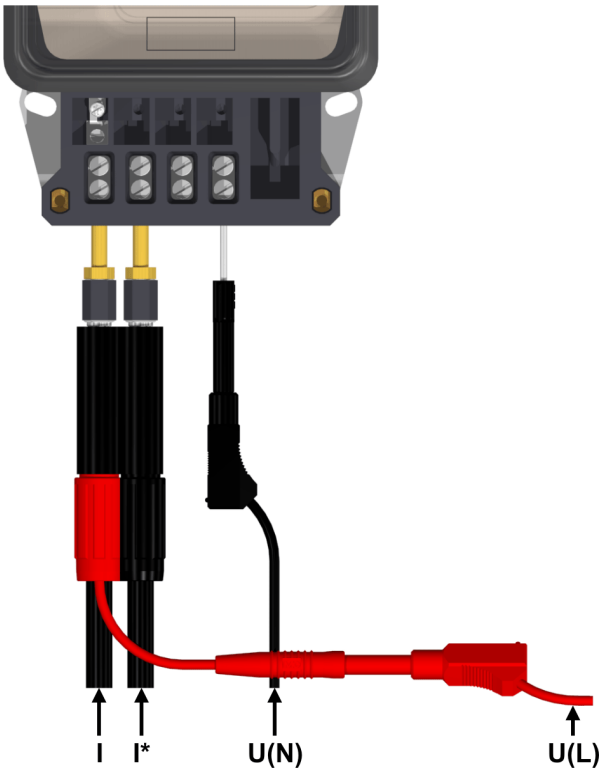


Direct connected
2-wire meter
Uninstalled on site or in laboratory
Maximum test current 120 A

Test links open



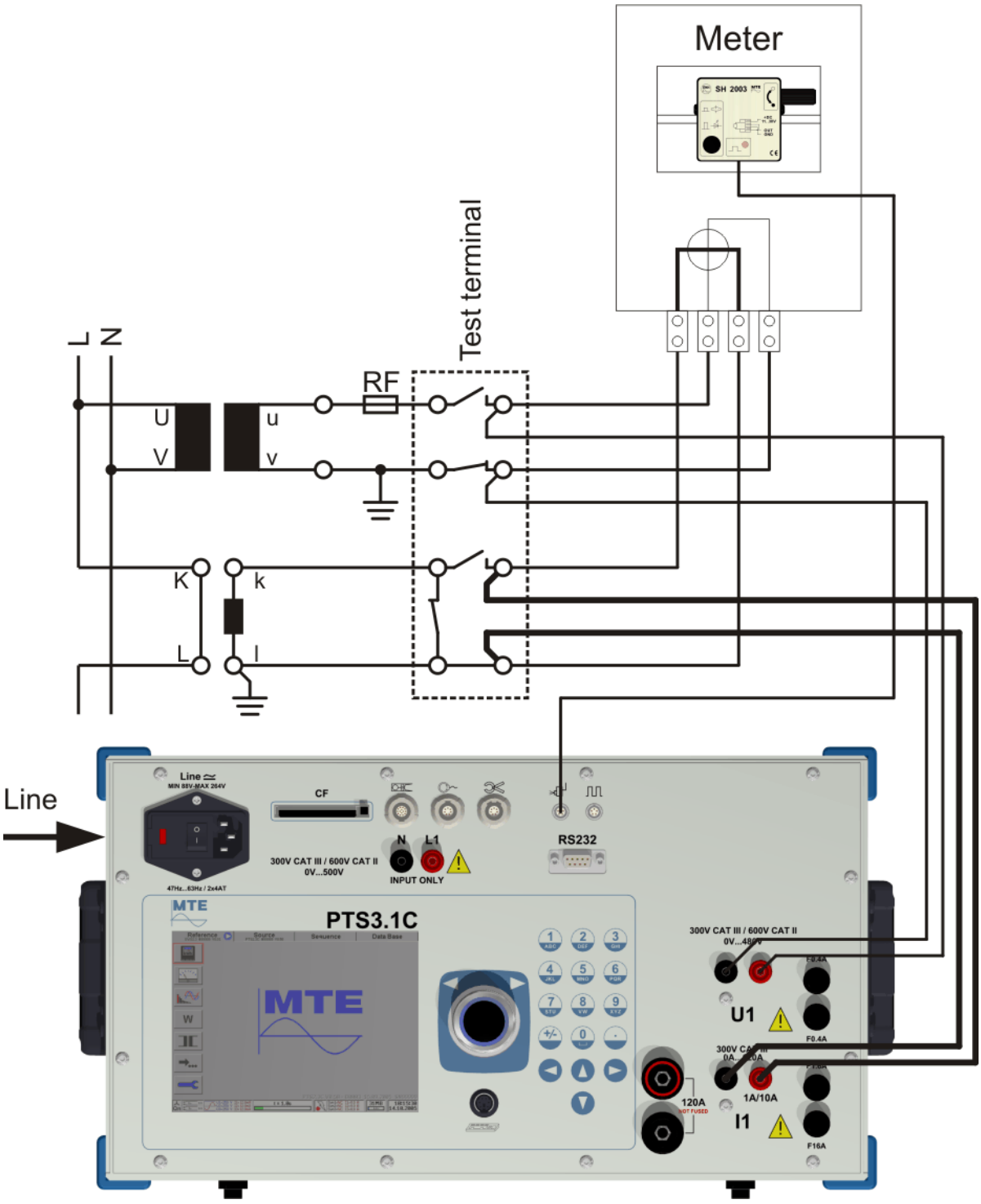
Test links closed



For other type of meters (ANSI Form S, Form A; British Standard BS etc.) consult the documentation delivered by the manufacturer and adapt the connections to the meter regarding your needs.

11.1.3 Testing of an installed transformer connected meter up to 10 A

Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
	120A 12A		Test System
≤10A: Ix 1:1	120A 12A		Reference + Source



Connections to test terminals

Use the delivered adapter pins and cables or if available special adapters and cables delivered with the test terminals for the connections to the PTS 3.1 C.



Attention! The current transformer must be short connected on the secondary side during the time the current connections to the meter are changed to the PTS 3.1 C.

The voltage path from voltage transformer to the meter must be interrupted, before making the connections between test terminal and PTS 3.1 C voltage output.

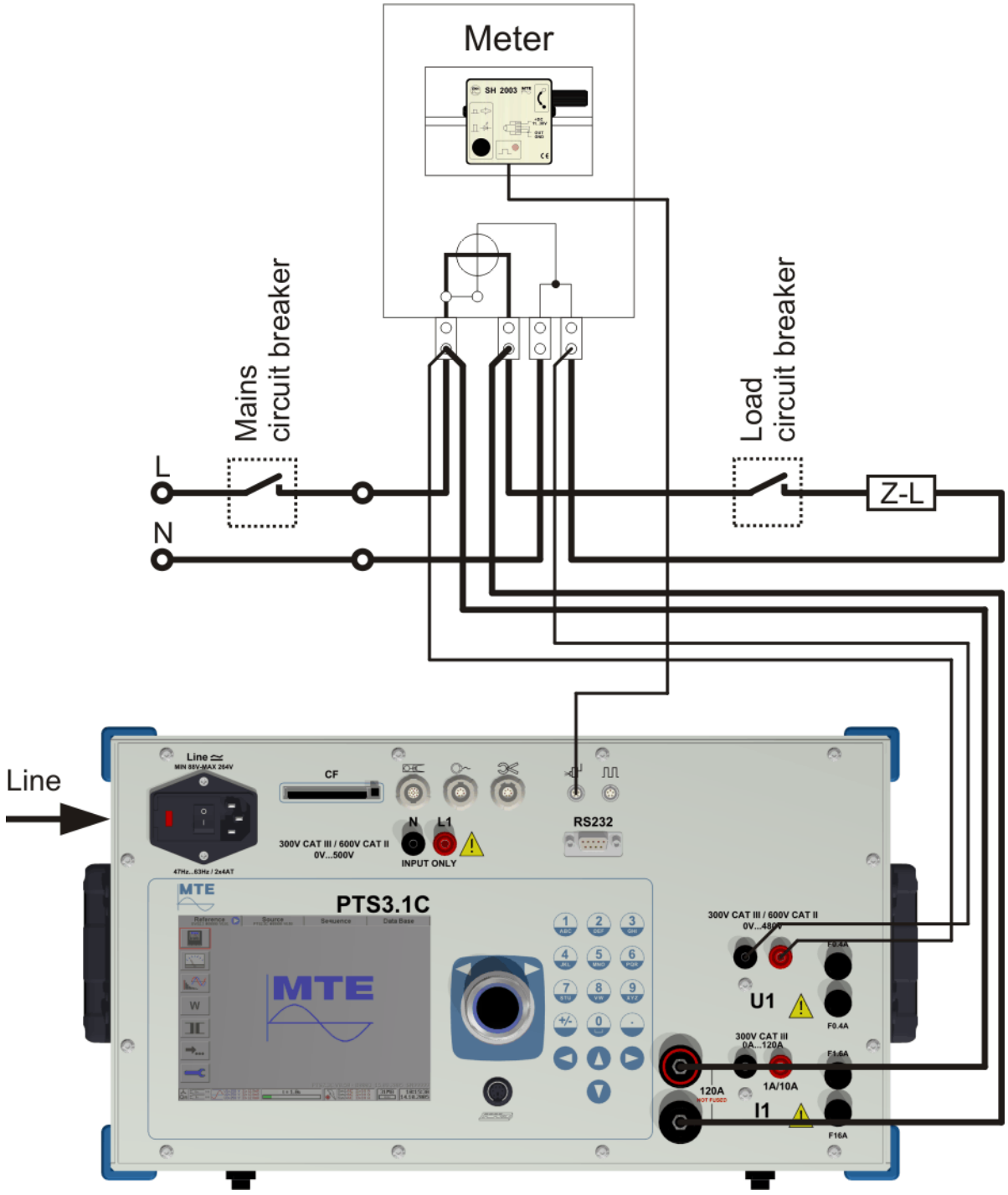
Regard the instructions for the use of the installed test terminals and observe local safety regulations.



Warning! The current path on secondary side of an active current transformer must always remain closed. Dangerous high voltages can occur and the current transformer and the instrument can be damaged, if the current path is opened during measurements.

11.1.4 Testing of an installed direct connected meter up to 120 A

Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	**Basic Control Mode**
	120A 12A		Test System
≤10A: 1:1 >10A: 1:1	120A 12A		Reference + Source

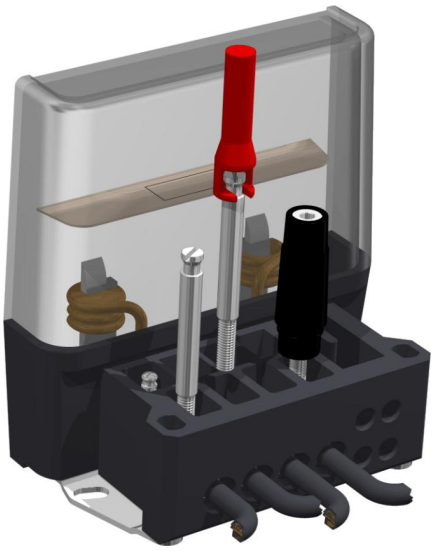


Connections to meter under test (example IEC-type meter)

Attention! The meter must be disconnected from mains and load during the time the tests are performed and during the connections to the PTS 3.1 C are made or released. Switch off mains and load circuit breakers.

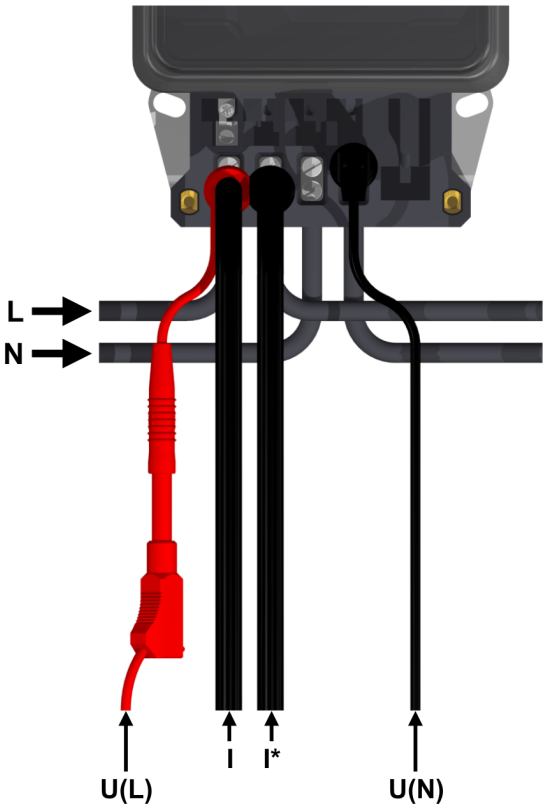
Observe local safety regulations.

Adapter pins



Direct connected
2-wire meter
Installed on site
Maximum test current 120 A

Test links closed

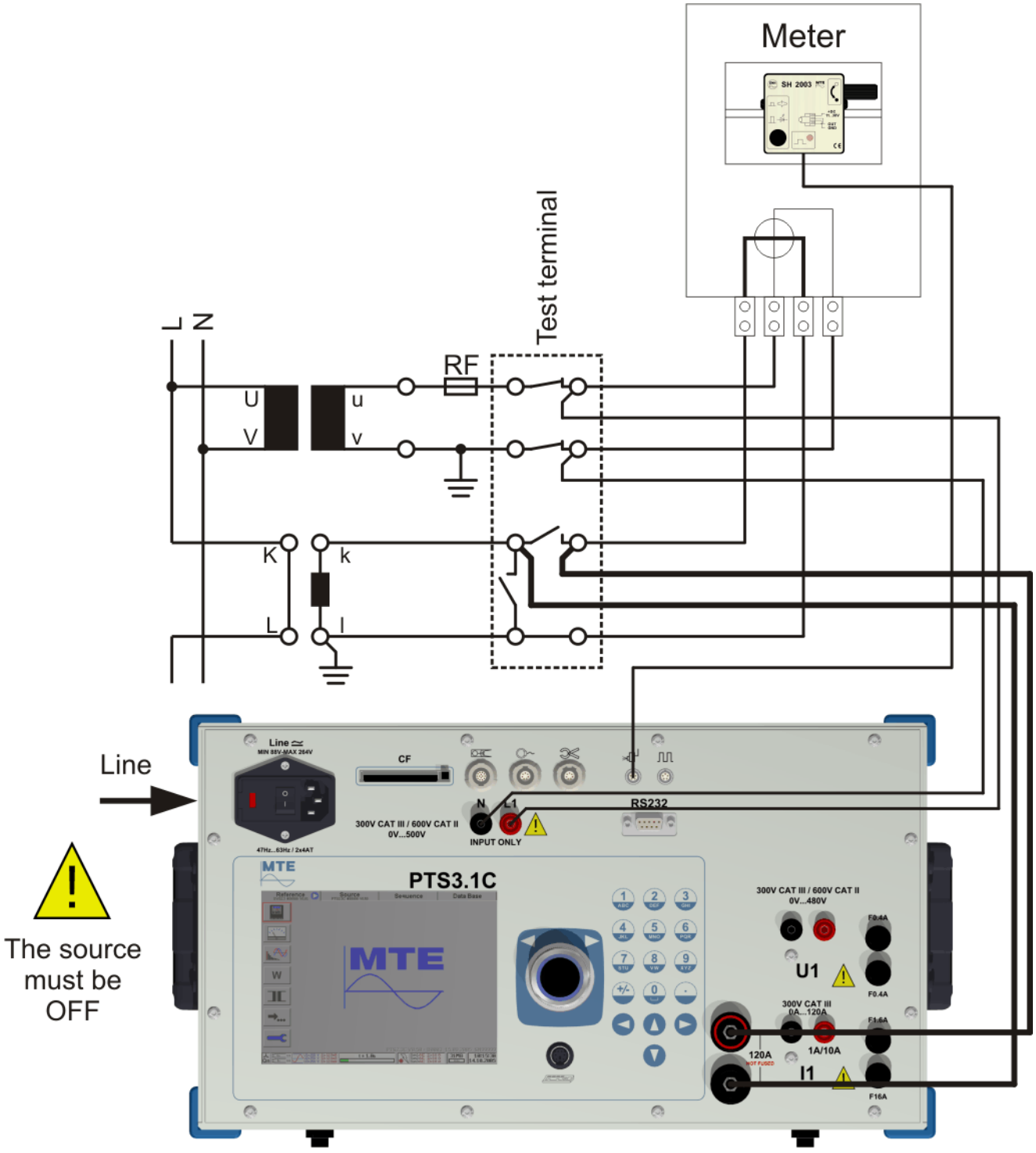


For other type of meters (ANSI Form S, Form A; British Standard BS etc.) consult the documentation delivered by the manufacturer and adapt the connections to the meter regarding your needs.

11.2 Connection examples using reference standard only

11.2.1 Testing of an installed transformer connected meter

Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	**Basic Control Mode**
≤12A:			Reference



Connections to test terminal

Use the delivered adapter pins and cables or if available special adapters and cables delivered with the test terminals for the connections to the PTS 3.1 C.



Attention! The current transformer must be short connected on the secondary side during the time the current path to the meter is opened and the connections to the PTS 3.1 C are made or released. Use the not fused 120A current input to measure the current.

Regard the instructions for the use of the installed test terminals and observe local safety regulations.



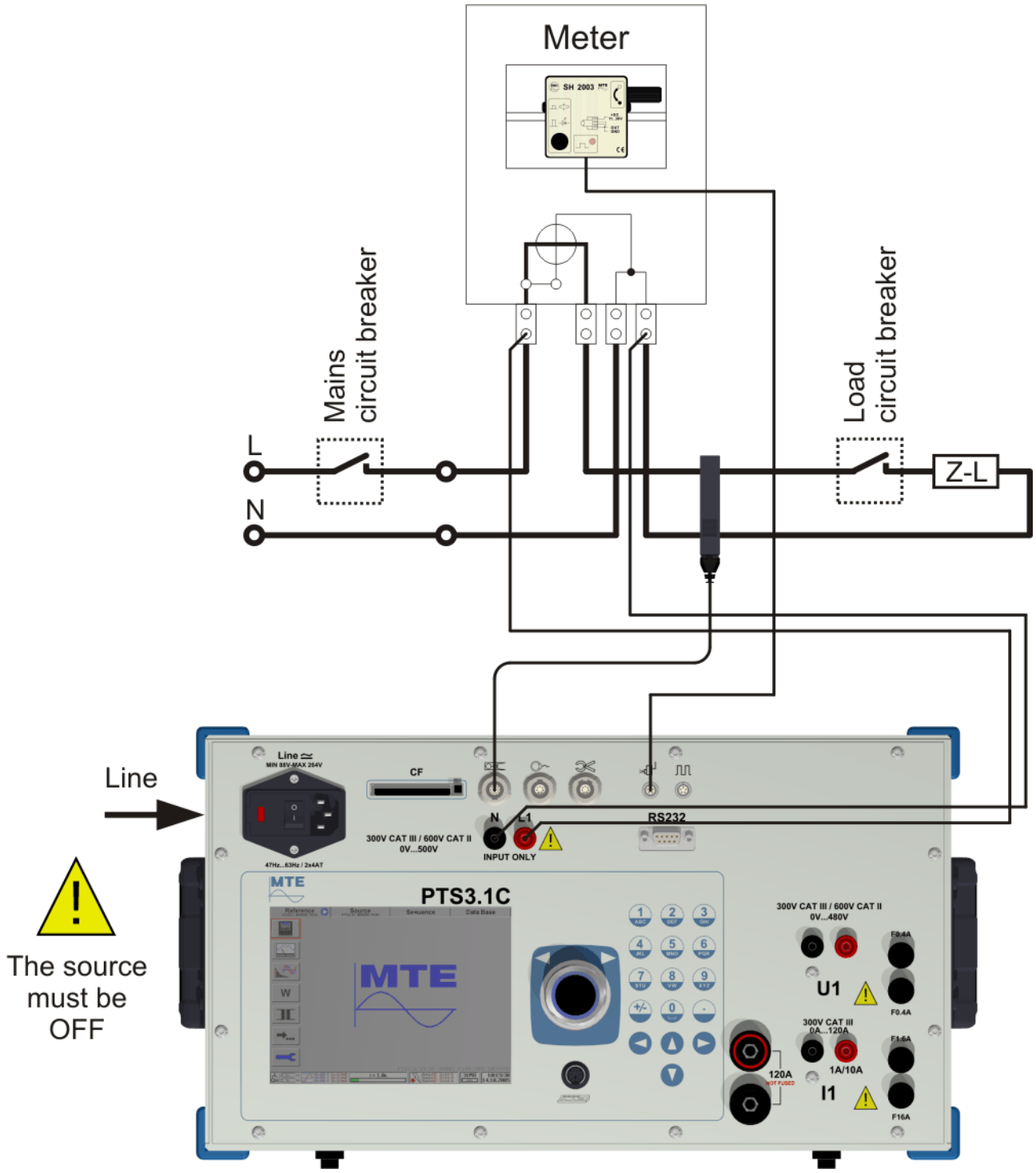
Warning! The current path on secondary side of an active current transformer must always remain closed. Dangerous high voltages can occur and the current transformer and the instrument can be damaged, if the current path is opened during measurements.

Note: In measurement mode the high current connectors can be used for the full specified current range. Currents <10A are measured with the same accuracy, as if measured by the 1A/10A current connectors.

Note: Adapter cables from high current connectors to 2.5mm^2 laboratory cables with 4mm safety connectors are available, if the high current cables cannot be used together with the existing test terminals.

11.2.2 Testing of an installed direct connected meter with clamp-on CT (100 A)

Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	**Basic Control Mode**
100A 1:1			Reference

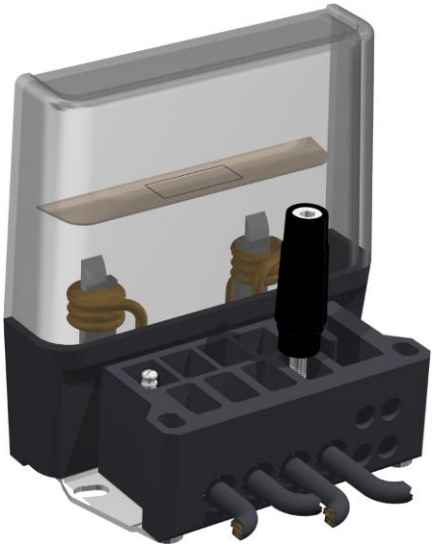


Connections to meter under test (example IEC-type meter)

Attention! For safety reasons, whenever possible, switch off the mains circuit breaker during meter manipulations to fix the adapter pins and omega clips for the voltage connections.

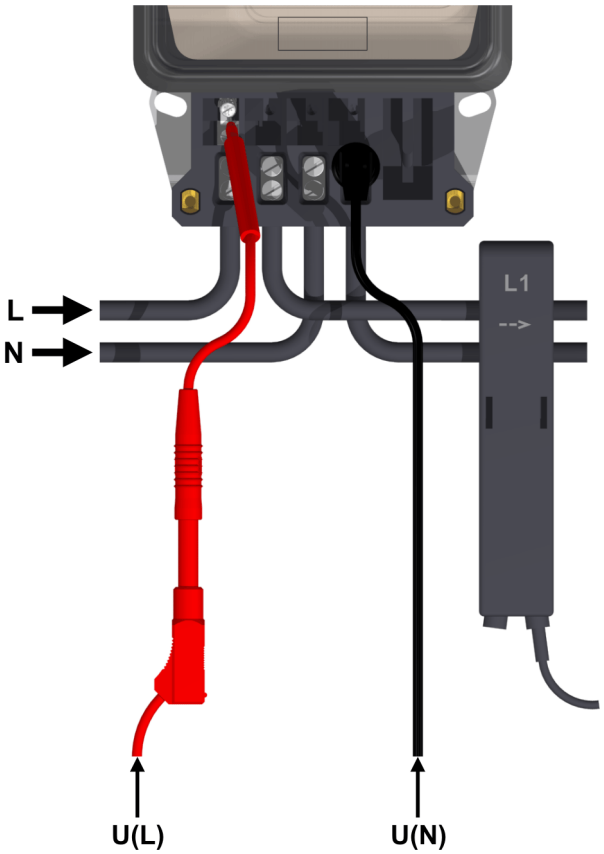
Observe local safety regulations.

Adapter pins



Direct connected
2-wire meter
Installed on site
Maximum test current 100 A

Test links closed

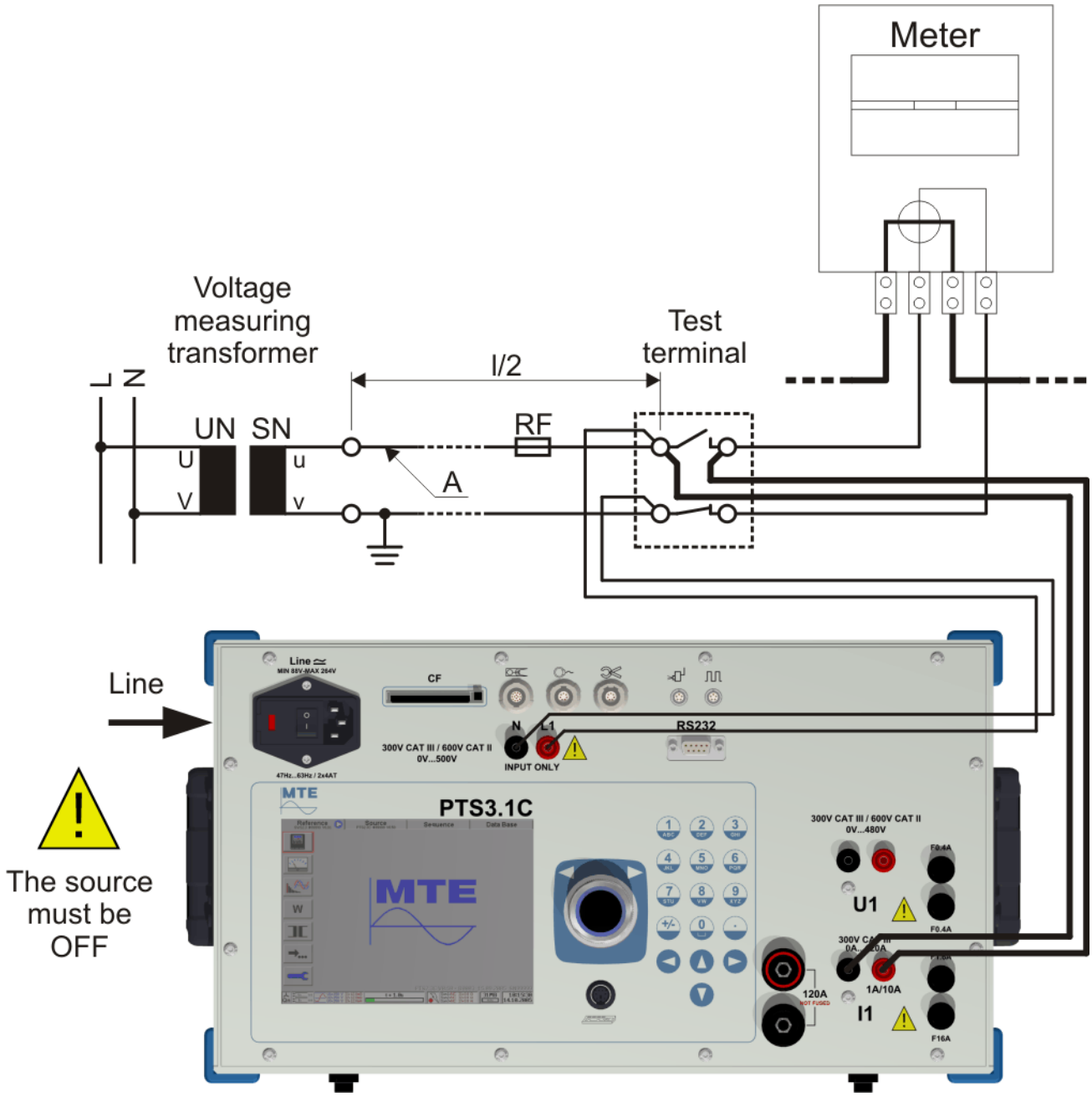


For other type of meters (ANSI Form S, Form A; British Standard BS etc.) consult the documentation delivered by the manufacturer and adapt the connections to the meter regarding your needs.

11.2.3 Burden measurement of voltage transformer

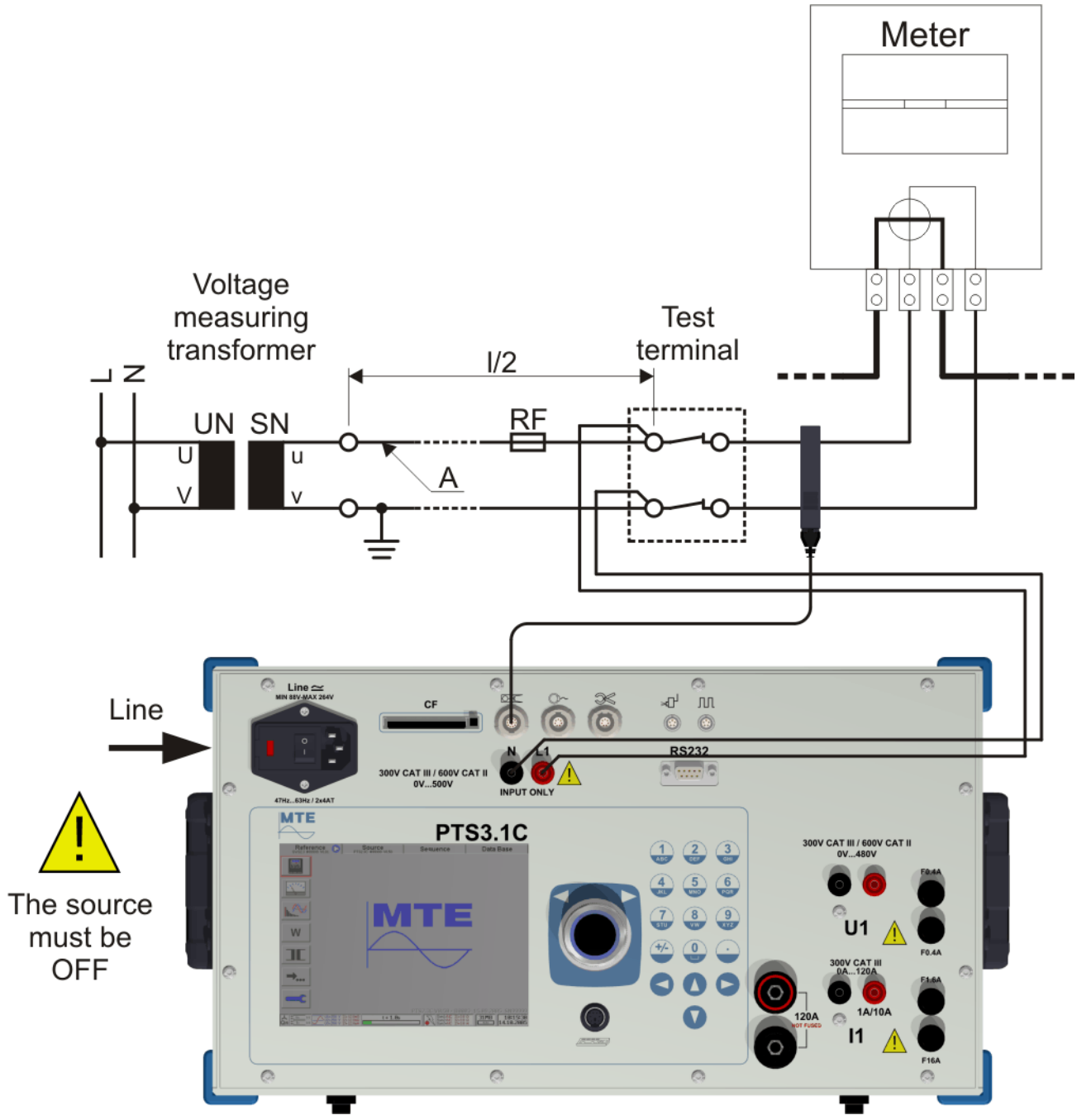
Example A: Secondary current measured direct

	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
	≤12A:			Reference



Example B: Secondary current measurement with clamp-on CTs

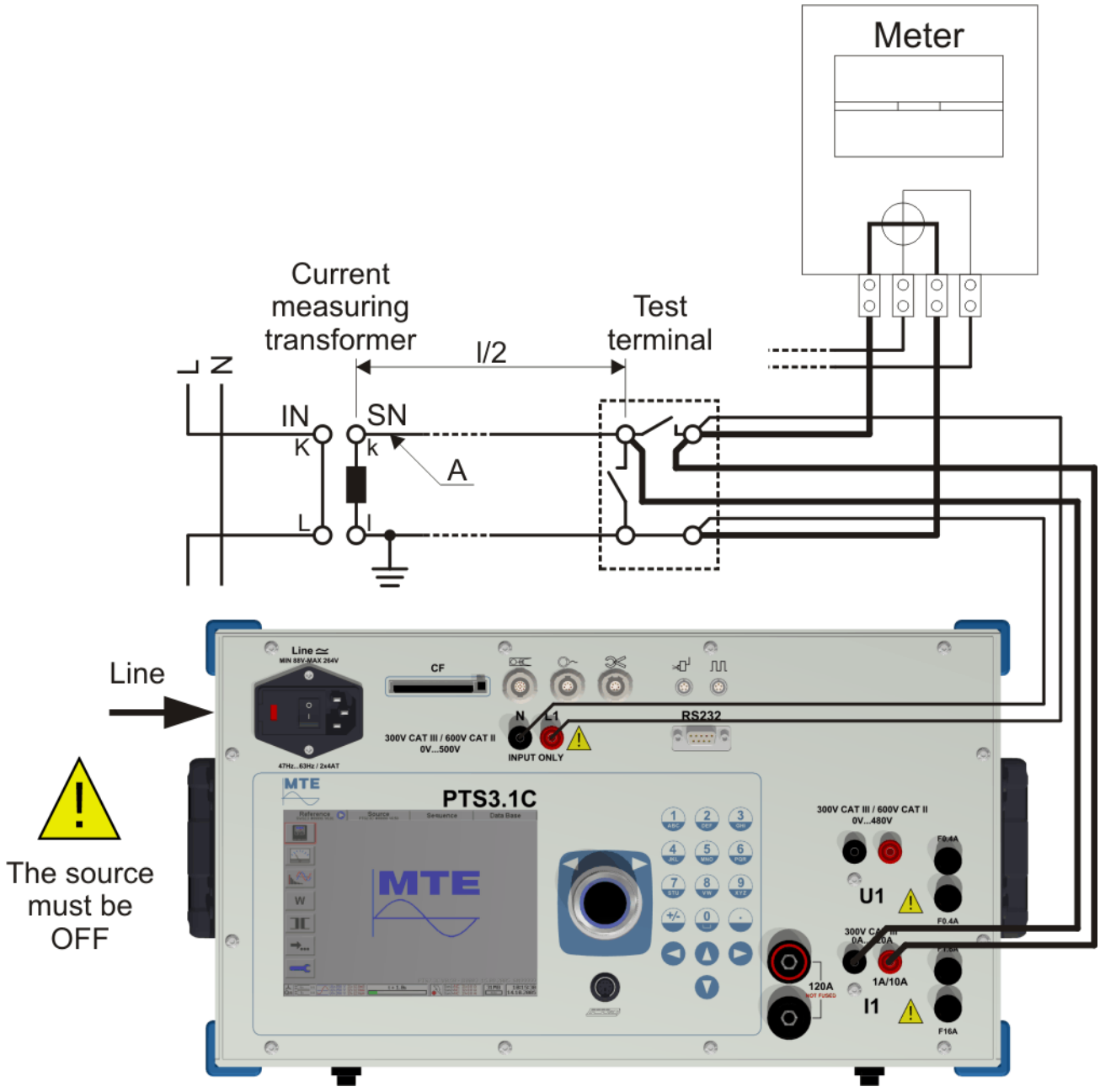
	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
				Reference



11.2.4 Burden measurement of current transformer

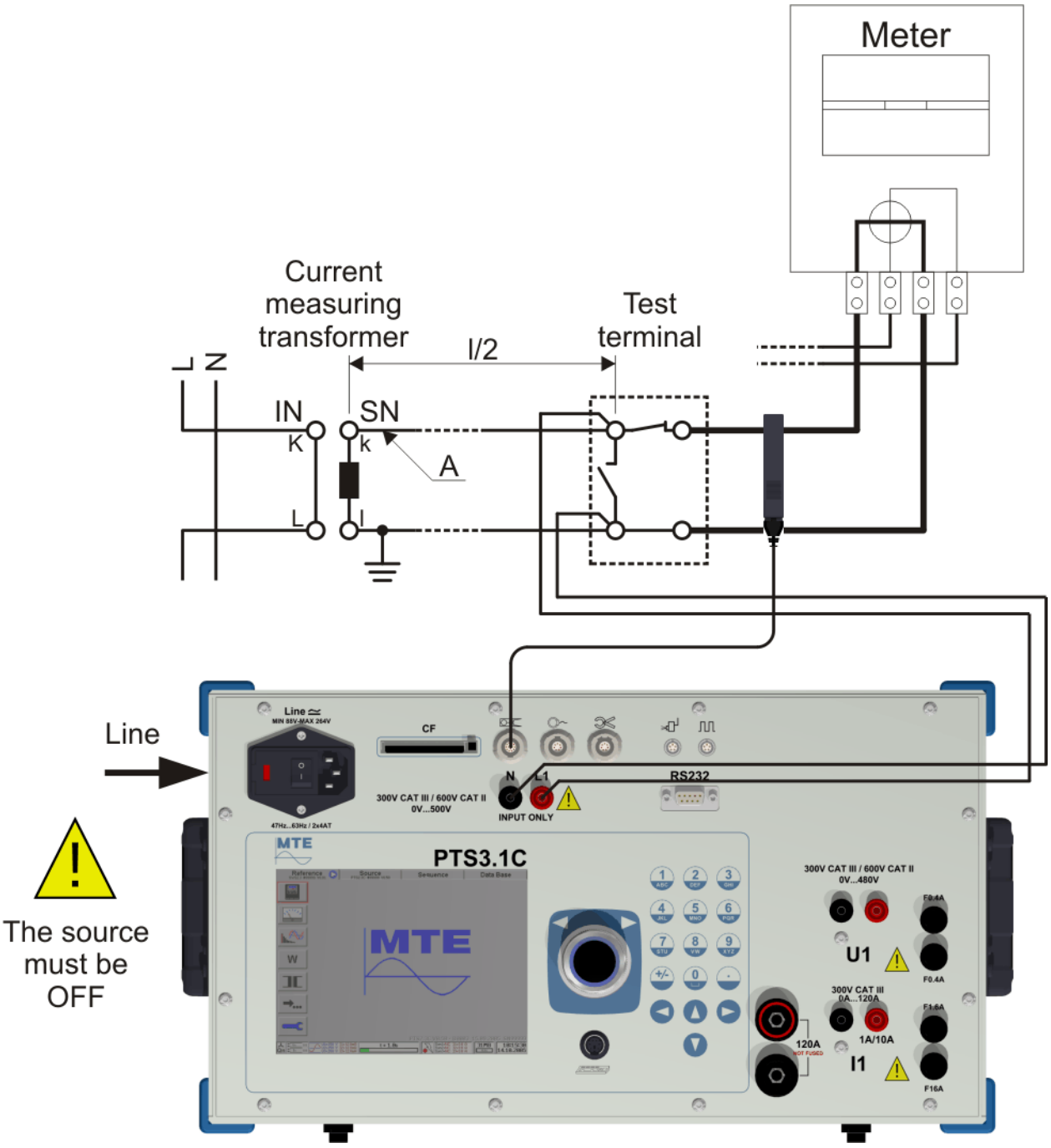
Example A: Secondary current measured direct

	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	**Basic Control Mode**
	≤12A: Ix 1:1			Reference



Example B: Secondary current measurement with clamp-on CTs

	Reference PRS1.3 #32442 V1.32	Source PTS3.3C #32442 V1.03	Data Base	Basic Control Mode
				Reference

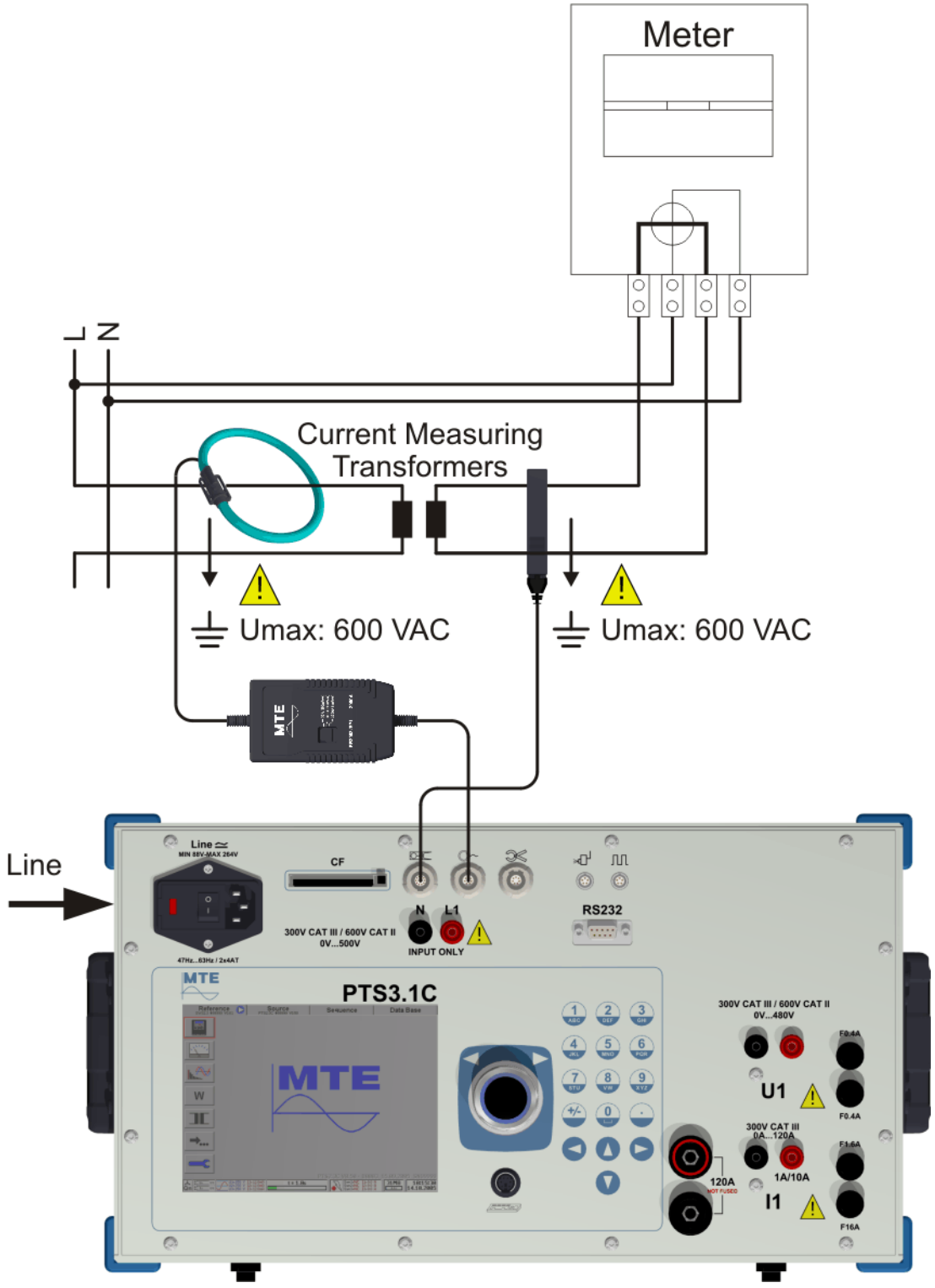


11.2.5 Transformer ratio measurement of current transformer

Example A: Primary current measured with clamp-on CTs (3000 A)
Secondary current measured with clamp-on CTs (100 A)

	Reference SWS2.3 #32452 V1.01	Source PTS2.3C #32452 V1.03	Data Base	Basic Control Mode
				Reference

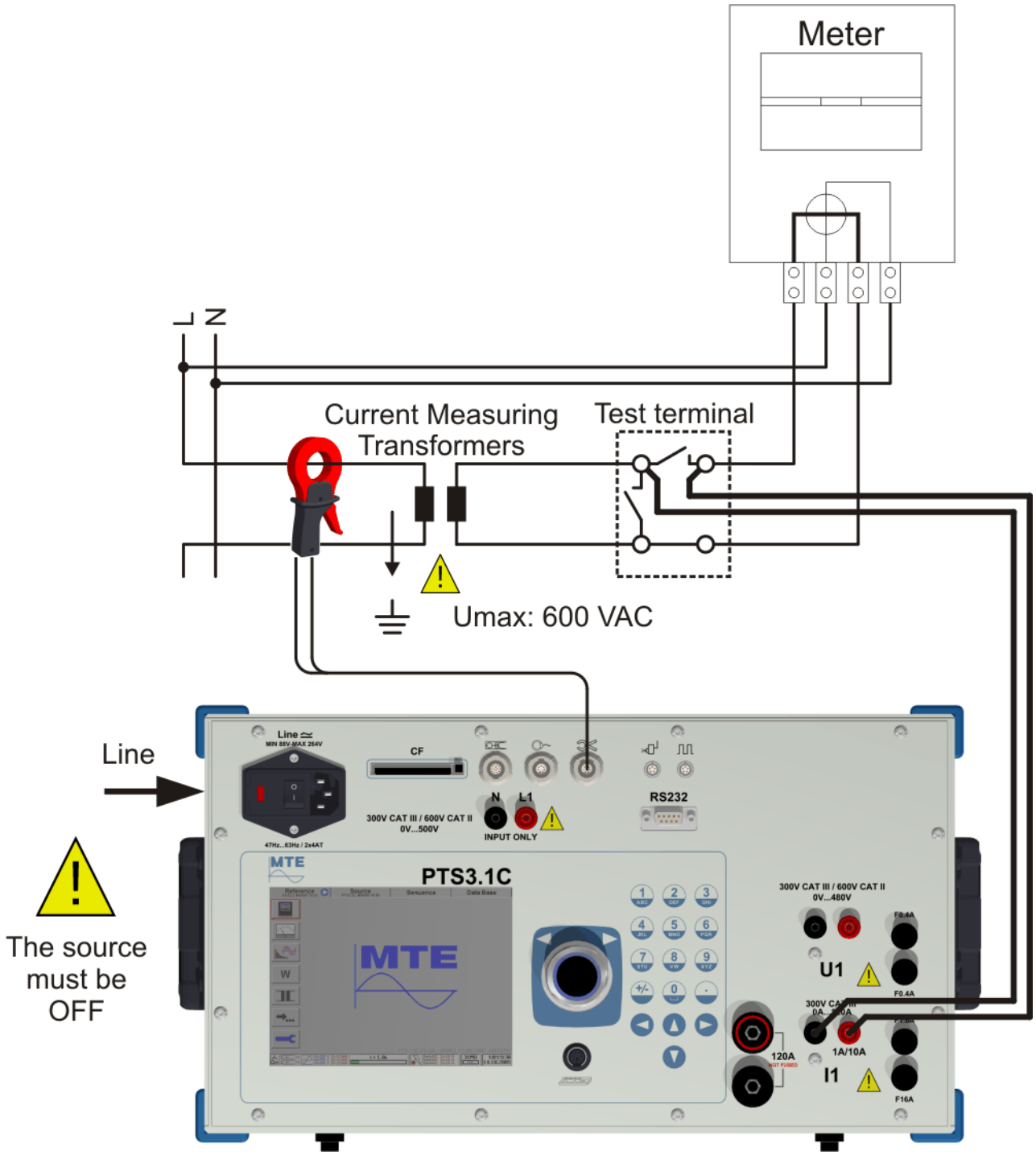
Note: The input selection for current measurements (Prim In, Sec In) is made in the setup of the CT ratio function



Example B: Primary current measured with clamp-on CTs (1000 A)
Secondary current measured direct (10 A)

Reference SWS2.3 #32452 V1.01	Source PTS2.3C #32452 V1.03	Data Base	**Basic Control Mode**
			Reference

Note: The input selection for current measurements (Prim In, Sec In) is made in the setup of the CT ratio function



12. Technical Details

12.1 Calculation formulae

The following chapter describes the formulae applied for a 3-phase 4-wire system. At the PTS 3.1 C only the formulae for the single phase values of L1 are relevant.

All calculations are based on 16 bit samples of the phase voltages u1, u2, u3 and of the phase currents i1, i2, i3. The 6 values are simultaneously sampled at a rate of 4 kHz. Every sample is corrected in amplitude and phase before further calculations are carried out. The correction parameters used have been determined during manufacture and are stored in the internal non-volatile memory.

Table 12-1 Definition of basic measured variables

			Indications on instrument				
Name	Mode	Value	Qn	L1	L2	L3	Σ
Current		Ix		I_1	I_2	I_3	
Voltage phase-to-neutral		Ux		U_1	U_2	U_3	
Voltage phase-to-phase		Uxy		U_{12}	U_{23}	U_{31}	
Active power 4-wire	P4	P4x		P_1	P_2	P_3	
Active power 3-wire	P3	P3x		P_1		P_3	
Reactive power, artificial, 4-wire	K4	QK4x	Qx	Q_1	Q_2	Q_3	
Reactive power, artificial, 3-wire	K3	QK3x	Qx	Q_1		Q_3	
Reactive power, natural, 4-wire	N4	QN4x	Qn	Q_1	Q_2	Q_3	
Reactive power, natural, 3-wire	N3	QN3x	Qn	Q_1		Q_3	
Apparent power 4-wire	S4	S4x		S_1	S_2	S_3	
Total active power 4-wire	P4	PΣ4					PΣ
Total active power 3-wire	P3	PΣ3					PΣ
Total reactive power, artificial, 4-wire	K4	QKΣ4	Qx				QΣ
Total reactive power, artificial, 3-wire	K3	QKΣ3	Qx				QΣ
Total reactive power, natural, 4-wire	N4	QNΣ4	Qn				QΣ
Total reactive power, natural, 3-wire	N3	QNΣ3	Qn				QΣ
Total apparent power 4-wire	S4	SΣ4					SΣ
Total apparent power 3-wire	S3	SΣ3					SΣ
Power factor per phase 4-wire				PF_1	PF_2	PF_3	
Total power factor 4-wire / 3-wire							PF
Angle between current and voltage				φ_1	φ_2	φ_3	
Angle between voltage and voltage				φ_{U12}	φ_{U23}	φ_{U31}	
Angle between current and current				φ_{I12}	φ_{I23}	φ_{I31}	
Frequency							f

			Indications on instrument				
Name	Mode	Value	Qn	L1	L2	L3	Σ
Distortion factor current		kIx		kI1	kI2	kI3	
Distortion factor voltage		kUx		kU1	KU2	KU3	
Distortion factor active power		kPx		kP1	kP2	kP3	
Distortion factor reactive power		kQx		kQ1	kQ2	kQ3	
Distortion factor apparent power		kSx		kS1	kS2	kS3	
Harmonics of voltage hi (1)	P4	hUxi		U, hi	U, hi	U, hi	
Harmonics of current hi (1)	P4	hIxi		I, hi	I, hi	I, hi	
Harmonics of active power hi (1)	P4	hPxi		P, hi	P, hi	P, hi	
Harmonics of reactive power, artificial, hi (1)	K4	hQKxi	Qx	Q, hi	Q, hi	Q, hi	
Harmonics of reactive power, natural, hi (1)	N4	hQNxi	Qn	Q, hi	Q, hi	Q, hi	
Harmonics of apparent power hi (1)	S4	hSxi		S, hi	S, hi	S, hi	

Note
(1) i = 1 ... 31

Table 12-2 Calculation formulae

Value	Sample value x_n	RMS value / average value of one period Tm
U1 **U2** **U3**	$u1_n$ $u2_n$ $u3_n$	$Ux = \sqrt{\frac{1}{N} \cdot \sum_{n=1}^{N} ux_n^{\,2}} \quad ; x = 1,2,3$
U12 **U23** **U31**	$u12_n = u1_n - u2_n$ $u23_n = u2_n - u3_n$ $u31_n = u3_n - u1_n$	$Uxy = \sqrt{\frac{1}{N} \cdot \sum_{n=1}^{N} uxy_n^{\,2}} \quad ; x = 1,2,3 \quad ; y = 1,2,3$
I1 **I2** **I3**	$i1_n$ $i2_n$ $i3_n$	$Ix = \sqrt{\frac{1}{N} \cdot \sum_{n=1}^{N} ix_n^{\,2}} \quad ; x = 1,2,3$
IN	$iN_n = i1_n + i2_n + i3_n$	$IN = \sqrt{\frac{1}{N} \cdot \sum_{n=1}^{N} iN_n^{\,2}}$
P41 **P42** **P43**	$p41_n = u1_n \cdot i1_n$ $p42_n = u2_n \cdot i2_n$ $p43_n = u3_n \cdot i3_n$	$P4x = \frac{1}{N} \sum_{n=1}^{N} p4x_n \quad ; x = 1,2,3$
P31 **P33**	$p31_n = u12_n \cdot i1_n = (u1_n - u2_n) \cdot i1_n$ $p33_n = -u23_n \cdot i3_n = (u3_n - u2_n) \cdot i3_n$	$P3x = \frac{1}{N} \sum_{n=1}^{N} p3x_n \quad ; x = 1,3$
QK41 **QK42** **QK43**	$qK41_n = \frac{1}{\sqrt{3}} \cdot (u2_n - u3_n) \cdot i1_n$ $qK42_n = \frac{1}{\sqrt{3}} \cdot (u3_n - u1_n) \cdot i2_n$ $qK43_n = \frac{1}{\sqrt{3}} \cdot (u1_n - u2_n) \cdot i3_n$	$QK4x = \frac{1}{N} \sum_{n=1}^{N} qK4x_n \quad ; x = 1,2,3$

Value	Sample value x_n	RMS value / average value of one period Tm
QK31 **QK33**	$qK31_n = \sqrt{3}\cdot(-u3_n)\cdot i1_n$ $qK33_n = \sqrt{3}\cdot u1_n \cdot i3_n$	$QK3x = \frac{1}{N}\sum_{n=1}^{N} qK3x_n \quad ;x = 1,3$
QN41 **QN42** **QN43**	$qN41_n = \frac{2\pi}{N}\cdot u1\_90°_n \cdot i1_n$ $qN42_n = \frac{2\pi}{N}\cdot u2\_90°_n \cdot i2_n$ $qN43_n = \frac{2\pi}{N}\cdot u3\_90°_n \cdot i3_n$	$QN4x = \frac{1}{N}\sum_{n=1}^{N} qN4x_n \quad ;x = 1,2,3$
QN31 **QN33**	$qN31_n = \frac{2\pi}{N}\cdot u12\_90°_n \cdot i1_n$ $qN33_n = \frac{2\pi}{N}\cdot u32\_90°_n \cdot i3_n$	$QN3x = \frac{1}{N}\sum_{n=1}^{N} qN3x_n \quad ;x = 1,3$
S1 **S2** **S3**		$S1 = U1\cdot I1$ $S2 = U2\cdot I2$ $S3 = U3\cdot I3$
SΣ4		Apparent power mode: S=UΣ*IΣ $S\Sigma4 = \sqrt{U1^2 + U2^2 + U3^2}\cdot\sqrt{I1^2 + I2^2 + I3^2}$ Apparent power mode: S=sqrt(P^2+Q^2) $S\Sigma4 = \sqrt{P\Sigma4^2 + Qx\Sigma4^2} \quad ;x = N,K$
SΣ3		Apparent power mode: S=UΣ*IΣ $S\Sigma3 = \sqrt{U12^2 + U32^2}\cdot\sqrt{I1^2 + I3^2}$ Apparent power mode: S=sqrt(P^2+Q^2) $S\Sigma3 = \sqrt{P\Sigma3^2 + Qx\Sigma3^2} \quad ;x = N,K$
PΣ4		$P\Sigma4 = P41 + P42 + P43$
PΣ3		$P\Sigma3 = P31 + P33$
QKΣ4		$QK\Sigma4 = QK41 + QK42 + QK43$
QKΣ3		$QK\Sigma3 = QK31 + QK33$
QNΣ4		$QN\Sigma4 = QN41 + QN42 + QN43$
QNΣ3		$QN\Sigma3 = QN31 + QN33$
kU1 **kU2** **kU3** **kI1** **kI2** **kI3** **kP1** **kP2** **kP3** **kQ1** **kQ2** **kQ3** **kS1** **kS2** **kS3**		$kx = \frac{\sqrt{\sum_{i=2}^{127} hx_i^2}}{\sqrt{\sum_{i=1}^{127} hx_i^2}}\cdot 100 = \sqrt{\frac{\sum_{i=2}^{127} hx_i^2}{1+\sum_{i=2}^{127} hx_i^2}}\cdot 100 \ [\%]$ x = U1, U2, U3, I1, I2, I3, P1, P2, P3, Q1, Q2, Q3, S1, S2, S3

Definitions

f : Signal frequency

Tm : Signal period

$$Tm = \frac{1}{f}$$

fs : Sampling frequency

N : Samples per signal period

$$N = abs\left(\frac{fs}{f}\right)$$

n : Index for sample

$n = 1...N$

$ux\_90°$: Phase-to-neutral voltage with phase displacement of 90°, with digital integrator calculated from sample values ux.

(Because of the integration this is $\frac{N}{2\pi}$ times larger than voltage ux)

$uxy\_90°$: Phase-to-phase voltage with phase displacement of 90°, with digital integrator calculated from sample values uxy.

(Because of the integration this is $\frac{N}{2\pi}$ times larger than voltage uxy)

hx_i : Harmonics content with index i in relation to the fundamental wave

$$hx_i = \frac{Hx_i}{Hx_1}$$

$i = 1...127$

x : RMS value, $x = U1, U2, U3, I1, I2, I3$

Hx_i : RMS value of the harmonic of x with index i

Hx_1 : Fundamental wave (first harmonic), $hx_1 = 1$

Display during harmonics analysis in percent of the fundamental wave:

$khx_i = 100 \cdot hx_i$ (%)

Time base function

The DSP software calculates an average of the RMS and average values over a period Tm using the defined time base (T = 0.2 ... 9999s). In this case, only complete measuring signal periods Tm are considered (T/Tm).

Example: in the case of 50 Hz with a measuring signal period Tm = 20 ms and a time base T = 1s, an average is calculated over 50 RMS values or average values for each period.

12.2 Technical data

General

Auxiliary voltage:	88 VAC_{min} ... 264 VAC_{max}, 47 … 63 Hz
Power consumption:	320 VA_{max}
Housing:	Hard plastic, rubber protectors
Dimensions:	W 430 x D 218 x H 250 mm
Weight:	approx. 11 kg
Operation temperature:	-10 °C … +50 °C
Storage temperature:	-20 °C … +60 °C
Relative humidity:	≤ 85% at Ta ≤ 21°C
	≤ 95% at Ta ≤ 25°C, 30 days / year spread

Safety	CE certified
Isolation protection:	IEC 61010-1:2002
Measurement Category:	300 V CAT III, 600 V CAT II
Degree of protection:	IP-20

Voltage Source

Range (phase - neutral):	30 V … 480 V
Output power (per phase):	30 VA
Internal ranges (S_{max} / I_{max}):	300 V … 480 (600) V (30 VA / 0.05 A) 150 V … 300 V (30 VA / 0.10 A) 75 V … 150 V (30 VA / 0.20 A) 30 V … 75 V (30 VA / 0.40 A)
Distortion factor:	< 0.8 %
Resolution:	0.1 V
Accuracy:	0.3 % (45 Hz … 100 Hz)
Stability:	0.03 % (30 min) / 0.1 % (1 h)
Bandwidth:	30 … 2'000 Hz (3 dB)

Current Source

Range (per phase):	1 mA … 120 A
Output power (per phase):	60 VA
Internal ranges (S_{max} / U_{max}):	10 A … 120 A (60 VA / 0.5 V) 1 A … 10 A (25 VA / 2.5 V) 1 mA … 1 A (10 VA / 10 V)
Distortion factor:	< 0.8 %
Resolution:	min. 1 mA
Accuracy:	0.5 % (45 Hz … 100 Hz)
Stability:	0.03 % (30 min) / 0.1 % (1 h)
Bandwidth:	30 … 1'000 Hz (3 dB)
Phase angle:	-180.00 ° … +180.00 °
Resolution:	0.1 ° (45 … 100 Hz) / 1 ° (>100 Hz)
Frequency:	45 Hz … 400 Hz
Resolution:	0.1 Hz (45 … 100 Hz) / 1 Hz (>100 Hz)

Reference Standard - Measurement Range

Measuring Quantity	Range	Input / Sensor
Voltage (phase - neutral)	5 V … 500 V	L1, N or U1
	20 mV … 5 V	L1, N (CT Burden)
Current	1 mA … 12 A	1A/10A (I1)
	10 mA … 120 A	120A (I1)
	10 mA … 100 A	Clamp-on CT 100A
	100 mA … 1000 A	Clamp-on CT 1000A
	3 A … 3000 A	LEMflex 3000A

Reference Standard - Measurement Accuracy

Voltage / Current		≤ ± E [%] [1 2 4]
Measuring Quantity	Range	**Class 0.1**
Voltage (L1, N or U1)	30 V … 500 V	0.1
	5 V … 30 V	0.1
Current direct 1A/10A, 100A	120 mA … 120 A	0.1
	1 mA … 120 mA	0.1
Current clamp-on CT 100A	100 mA … 100 A	0.2
Current clamp-on CT 1000A	20 A … 1000 A	0.2
Current LEMflex 3000A	300 A … 3000 A 30 A … 300 A 3 A … 30 A	0.5 + E_M
Burden Voltage(L1,N)	500 mV … 5 V	0.5
	20 mV … 500 mV	0.5

Power / Energy Voltage: 30 V… 500 V (L - N)		≤ ± E [%] [1 2 3]
Measuring Quantity / Input I	Range	**Class 0.1**
Active (P), Apparent (S) Power / Energy		
Direct 1A/10A or 120A	120 mA … 120 A	0.1
	1 mA … 120 mA	0.1
Clamp-on CT100A	100 mA … 100 A	0.2
Clamp-on CT1000A	20 A … 1000 A	0.2
Reactive (Q) Power / Energy		
Direct 1A/10A or 120A	120 mA … 120 A	0.2
	1 mA … 120 mA	0.2
Clamp-on CT 100A	100 mA … 100 A	0.4
Clamp-on CT1000A	20 A … 1000 A	0.4

Influence of external magnetic fields (45 Hz … 66 Hz): ≤ 0.07 % / 0.5 mT [3]

Temperature coefficient (TC):

	≤ ± TC [%/°C] [3]
Range	**Class 0.1**
0° C ... +40°C	0.015
-10° C ... +50°C	0.025

CT Burden		≤ ± E [%] [1 2 5]
I (I1)	U (L1, N)	
120 mA… 120 A	500 mV … 5 V	0.6
120 mA… 120 A	20 mV … 500 mV	0.1 + 0.5

PT Burden		≤ ± E [%] [1 2 5]
I (I1)	U (L1, N)	
120 mA… 120A	30 V … 500 V	0.2
1 mA … 120 mA	30 V … 500 V	0.1 + 0.1

CT Ratio		≤ ± E [%] / Δφ [°] [1 2 6]
IP - Input / Range	IS (I1)	
Clamp-on CT 100A		
100 mA… 100 A	120 mA … 120 A	0.3 / 0.3
100 mA… 100 A	1 mA … 120 mA	0.2 + 0.1 / -
Clamp-on CT 1000A		
20 A …1000 A	120 mA … 120 A	0.3 / 0.3
20 A …1000 A	1 mA … 120 mA	0.2 + 0.1 / -
LEMflex 3000A		
300 A … 3000 A	120 mA … 120 A	0.6 + E_M / -
30 A …300 A	1 mA … 120 mA	0.5 + E_M + 0.1 / -
3 A …30 A		

Frequency / Phase Angle / Power Factor		≤ ± E
Measuring Quantity	Range	
Frequency (f)	40 Hz … 70 Hz	0.01 Hz
Phase Angle (φ)	0.00 °… 359.99°	0.1 °
Power Factor (PF)	-1.000… +1.000	0.002

Notes

[1] x.x :Related to the measuring value
x.x :Related to the measuring range final value (full scale, FS),
E(M) = FS/M * x.x (e.g. 0.1, FS =120 mA: E(20mA) = 120/20*0.1=0.6 %)

[2] Fundamental frequency in the range 45 … 66 Hz

[3] S: x.x, P,Q: x.x / PF (related to apparent power), 3- and 4-wire networks

[4] E_M: Accuracy specified by manufacturer of clamp-on CT or sensor

[5] E[%]: Accuracy of operating burden Sn [VA]

[6] E[%]: Accuracy of ratio E; Δφ[°]: Phase shift of phase displacement φ.

Pulse Input Suitable for scanning head type SH 2003

Input level: 4 … 12 VDC (24 VDC)

Input frequency: max. 200 kHz

Input supply: 12 VDC (I < 60 mA)

Pulse Output

Output level: 5V

Pulse length: ≥ 10µs

Meter constant

Active, Reactive, Apparent [imp/Wh(varh,VAh)]

C = 72’000’000 / (In * Un) [… / Wh]

The meter constant depends on the highest selected internal ranges of In, Un.

	Internal current ranges In [A]			
Direct I1	0.12	1.2	12	120
Clamp-on CT 100A	0.12	1.2	12	120
Clamp-on CT 1000A	1.2	12	120	1200
	Internal voltage ranges Un [V]			
Direct L1, N or U1	250		500	

Example: In = 12A, Un = 250V

C = 72’000’000 / (12 * 250) = 24’000

Output frequency:

C’ = C / 3’600 [imp/Ws(vars, VAs)]

fo = C’ *P(Q, S)

f_{max} = 72’000’000 / (12 * 250 * 3’600) *
* 12 * 250 = 20’000 [imp/s]